S·A·E JOURNAL

Published Monthly By The Society of Automotive Engineers, Inc.

W. J. Davidson, President — David Beecroft, Treasurer

John A. C. Warner, Secretary and General Manager

Norman G. Shidle, Executive Editor

Vol. 44 — FEBRUARY, 1939 — No. 2

CONTENTS

Overflow Crowds Fill Sessions at 1939 Annual meeting - - 13

Engineering for National Defense - - - - - - - - - - 17

Officers for 1939 - - - - - - - - - - - - - - - - - 21

Vice-Presidents Representing SAE Activities, 1939 - - - - 22

1939 Councilors - - - - - - - - - - - - - - - - - - 24

SAE World Automotive Engineering Congress *(insert following p. 24)*

(Transactions Section Begins)

Recent Developments in Piston-Ring Materials – *B. A. Yates* - 49

Magnaflux – What Does It Show? – *J. B. Johnson* - - - - 59

Magnaflux Indications Interpreted – *Bishop Clements* - - - - 68

Why Not 125 BMEP in an L-Head Truck Engine? – *F. S. Baster* 72

Recent European Developments in High-Speed Diesel Engines – *P. M. Heldt* - - - - - - - - - - - - - - - - - - 77

Coordinating Aircraft-Engine Design and Production – *A. H. Leak* - 85

(Transactions Section Ends)

News of the Society - - - - - - - - - - - - - - - - 38

SAE Coming Events - - - - - - - - - - - - - - - - - 40

About SAE Members - - - - - - - - - - - - - - - - - 41

New Members Qualified - - - - - - - - - - - - - - - 42

Applications Received - - - - - - - - - - - - - - - - 42

Reports of Committees - - - - - - - - - - - - - - - 43

SAE Papers in Digest - - - - - - - - - - - - - - - - 49

About Authors

● **Forest S. Baster** *(M '20), after graduating from the Case School of Applied Science with the class of '18, entered the automotive industry and has remained pretty close to it ever since. He had been associated with Packard, Grant, the H. J. Walker Co., Buick, GMC Research Corp., Lafayette, Paige, Hupmobile and Lycoming, before joining the White Motor Co. of which he is now chief engineer.*

● **Bishop Clements** *started with the Curtiss Aeroplane & Motor Co. shortly after graduating from Georgia Tech in 1915. After working in various departments he was placed in charge of the physical testing laboratory and experimental heat treating. He was later advanced to foreman of the heat treating and finishing departments, and then to metallurgist. He held the latter position for eight years prior to 1931 when the Curtiss Aeroplane & Motor Co. and the Wright Aeronautical Corp. combined their engine manufacturing. Since then he has been at Wright Aeronautical as chief metallurgist.*

● **P. M. Heldt** *(M '06) had his first contact with the automotive industry back in 1898 when he left a manufacturer of electrical machinery, with which he had been affiliated since graduating from college in 1894, to join the Munson Co., of Laporte, Ind., which was developing a combination gasoline-electric automobile. Leaving that company he joined Western Electric, remaining with them for a few years before going to Europe, where he visited Germany, Belgium and France. He covered the Paris World's Fair of 1900 as editorial representative for "Electrical World" and "Horseless Age." Returning to the United States he joined the editorial staff of "Horseless Age" (now "Automotive Industries") for which publication he still writes as engineering editor. Mr. Heldt is author of numerous widely used automotive text books, many of which have been translated into several languages.*

● **J. B. Johnson,** *after leaving Cornell University with an M.E. degree in 1912, spent six years in the motive power and mechanical engineering departments of the*

(Concluded on page 48)

Publication Office, 56th and Chestnut Sts., Philadelphia, Pa.; Editorial and Advertising Departments at the headquarters of the Society, 29 West 39th St., New York, N. Y. Western Advertising Office, Room 2-136 General Motors Bldg., Detroit, Mich.

The Society is not responsible for statements or opinions advanced in papers or discussions at its meetings or in articles in the JOURNAL.

REMEMBER 'WAY BACK IN 1938?

A LONG, long time ago, as our fast-moving automobile industry reckons, you were plenty busy creating the very cars which today's buyers are just now getting used to.

And Bendix, as for many years before, was trying to flag your attention in time to be as useful as possible to you . . . just as we are doing now.

Far ahead as you must work, Bendix engineering staffs must push the calendar still further forward! You can't stop and wait for us to work out improvements in our special units—carburetors, brakes, gear shifting and the like. When you want 'em, you want 'em—naturally.

And that, gentlemen, is precisely why we are addressing you so earnestly.

Remember 'way back when the 1939 cars were introduced? The significant changes—advancements—were in phases of design with which Bendix had been prominently and intimately concerned: finger-tip gear shifting, better braking and more efficient carburetion.

Right now, Bendix has, fully developed and ready for application to your 1940 chassis layouts, many things that represent distinct advancements over current practice.

These developments concern carburetion, braking, gear control, steering, remote throttle and clutch manipulation, propeller-shaft smoothness and other phases of performance. May we have an hour or so with you very soon?

BENDIX PRODUCTS

DIVISION OF

BENDIX AVIATION CORPORATION

South Bend, Indiana

Overflow Crowds Fill Sessions at 1939 Annual Meeting

IN sessions packed with ideas and action, thousands of SAE members at the 1939 Annual Meeting of the Society in Detroit, Jan. 9-13, combined to extend the bounds of technical knowledge on every automotive front – on land and in the air.

With a total attendance 25% greater than the record-breaking crowd of 1937, the whole meeting almost seemed in itself to be a direct answer to the plea made by President W. J. Davidson in his inaugural address that engineers "accept rather than shun offers to demonstrate what engineering is all about."

Attentively received were practical messages from high-ranking officers of the U. S. Army and Navy about the part automotive engineers and industrialists have played and will play in development of vital National defense projects. The full story of the momentous National defense phases of the program is told on pages 17-20 of this issue.

Important debates about current engine problems were generated in both passenger car and aircraft fields, centering sometimes around lubricants or fuel questions and sometimes around other phases of powerplant operation. Diesels as well as spark-ignition engines got major attention.

Car road noises, tires . . . safety-lane testing and compulsory motor-vehicle inspection . . . motor-vehicle air conditioning and control of exhaust-gas odors . . . almost every conceivable phase of automotive engineering was attacked in one or another of the 20 technical sessions during the week.

"Service Brings Greatness" – Davidson

"A group of people or a society, technical or otherwise, grows great only by constantly enhancing its service to the world at large," President W. J. Davidson emphasized in his inaugural address at the National Defense Dinner. He pointed to SAE Standards work as an illustration of an early service which has continued to be vital through the years and stressed the Engineering Relations Committee activity ("focusing the facts and technical data from many SAE sources to meet information needs of scores of outside groups") as a most recent example of expanded service by and for SAE members. President Davidson also urged increased emphasis on the Student Activity of the Society.

He showed the benefits to individual engineers which might be expected from improvement of public relations and expansion of the intellectual horizons of technical men, concluding:

"We should make available to more and more people within and without our own circle the skill and training inherent in the SAE."

Turning over the duties of the Presidency to Mr. Davidson, Past-President C. W. Spicer emphasized that the achievements of the SAE result from the cooperative efforts of thousands of individual members and expressed his appreciation of the effective efforts of the officers, committees, and members during his administration.

Annual Meeting photographs by Grossman-Knowling, Inc.

Caterpillar President Toastmaster

B. C. Heacock, president, Caterpillar Tractor Co., was toastmaster at the National Defense Dinner and developed industry's viewpoint as regards the opportunities for cooperation with the military establishments of the Government. He was introduced by R. N. Janeway, chairman of the SAE Detroit Section.

"Industry shares with other agencies," Mr. Heacock said, "the joy of building men . . . our man power, in capacity if not in numbers, is of a much higher order because of the constant effort of industry to develop all industrial workers. . . . When the Government attempts useful, productive work it is apt to destroy more private enterprise than it possibly can replace. . . .

"Industry can and should," Mr. Heacock emphasized, "make available to our 130,000,000 citizens tomorrow, as never before, the skill of our engineers. . . . Continuously we shall have to support and defend ourselves with proportionately more older and fewer young people. Here is a challenge to industry – particularly to engineers.

"Industry and our National defense forces working together cooperatively," he concluded, "can successfully defend our great Nation against any threat."

Life Membership to Teetor

Life membership in the Society was conferred upon Past-President Ralph R. Teetor at the Business Session on Tuesday evening. President Spicer made the presentation, characterizing Mr. Teetor as one who "has served the Society as a worker, as an adviser, and as a leader in the fullest measure."

Members-at-large to the National Nominating Committee

Together at SAE Meeting

C. F. Kettering, vice-president, General Motors Corp.; F. M. Zeder, vice-chairman of the board, Chrysler Corp.

were elected at this session and the proposed constitutional amendment to give voting privileges to Service Members of the Society was passed. This amendment now will be submitted by letter ballot to all members entitled to vote.

Flying and Television

News flashes of Nation-wide interest sprang from the Junior-Student session on the opening night of the meeting when it was predicted that air-transport cruising operation will be raised to between 16,000 and 20,000 ft before the end of 1939 and the announcement was made that, with the opening of the World's Fair in New York, scheduled television programs will be on the air there and in other cities. A. C. Hazard presided at this session which was sponsored by the Junior-Student Activity of the Detroit Section.

With our present knowledge, 20,000 ft appears to be the top economical limit for sub-stratosphere flying, according to D. W. Tomlinson, chief test pilot of Transcontinental & Western Air, Inc., who spoke first to the junior-student group. "In fact," he said, "it looks as though revolutionary improvements in powerplants and propulsive methods will have to come before the dream of passenger transports flying through the stratosphere can come true."

These conclusions Mr. Tomlinson gave after describing the long series of dramatic test flights by which he had accumulated data about this little-known field. When the air-transport cruising operations are raised to between 16,000 and 20,000 ft, he said, the pressure cabin and cockpit will be equipped to maintain 8000-ft pressure at the lower level and 12,000-ft pressure at 20,000 ft, which upper level will be used in an emergency. Operations at these levels, he said, is economically sound.

Commercial television was started more than two years ago in England and it costs the Government about $1000 per broadcast-hr, this same junior-student group learned from Albert F. Murray, engineer in charge of television, Philco Radio & Television Corp., who demonstrated television for his audience, reviewed its nature, and discussed its status and possibilities.

The British are doing a good job technically, Mr. Murray said, but pointed out that only about 5000 receivers have been sold there and that public acceptance is considered disappointing.

The Germans announced commercial television several years ago, too, he said, but relatively few receivers are in the hands of the public there, although military uses have not been overlooked. Modern television is just starting in France, he pointed out, while little has been reported from Italy, Russia, or Japan.

At least eight large companies have been active in television development in the United States, Mr. Murray showed, and, as a result of laboratory and field tests, steady improvement has been made in picture definition, in simplicity, and performance of television receivers. When the scheduled television programs go on the air this year, he said, cathode-ray television receivers producing excellent 441-line images will be offered to the public. Several types will be made available, the screens varying from 7 to 12 in.

Widespread commercial television in the United States, Mr. Murray said, will require: issuance of commercial transmitting licenses by the Federal Communications Commission; investment of large sums in television transmitters, studios, and associated equipment, because even a modest installation can easily exceed $200,000; provision of program sources – a gigantic task; and a setting up of a television network, interconnecting television transmitters so as to permit chain broadcasting. He warned that early television buyers should not expect "too much in hours of broadcast nor in program quality."

The Forum on Exhaust-Gas Analysis, at which J. B. Macauley, Jr., presided, was another important opening day event. Only SAE members were permitted to attend and reporting was prohibited.

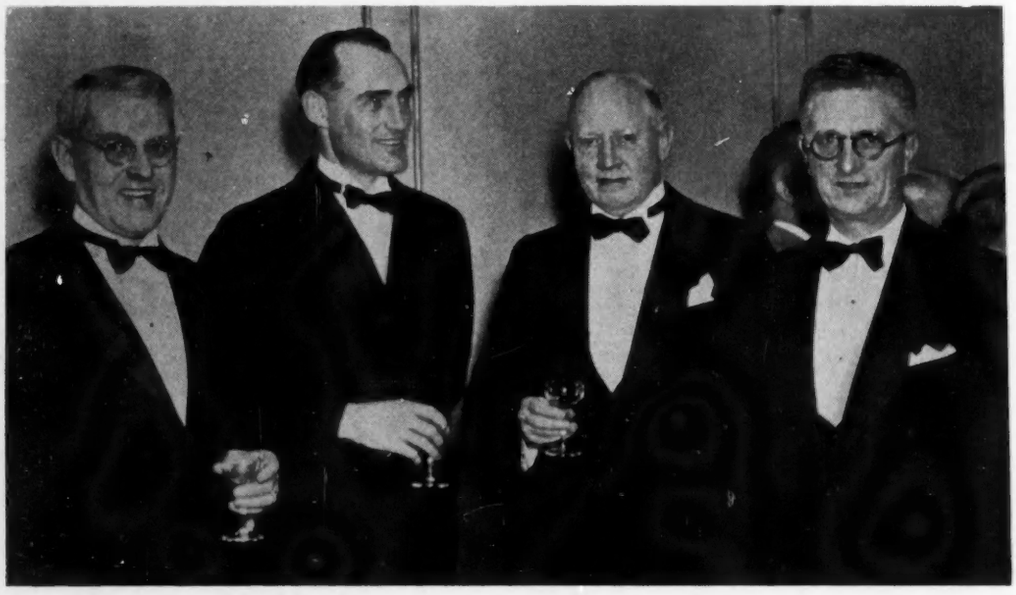
Passenger-Car Sessions

Chairmen

C. R. Paton — **W. C. Keys** — **J. E. Hale**

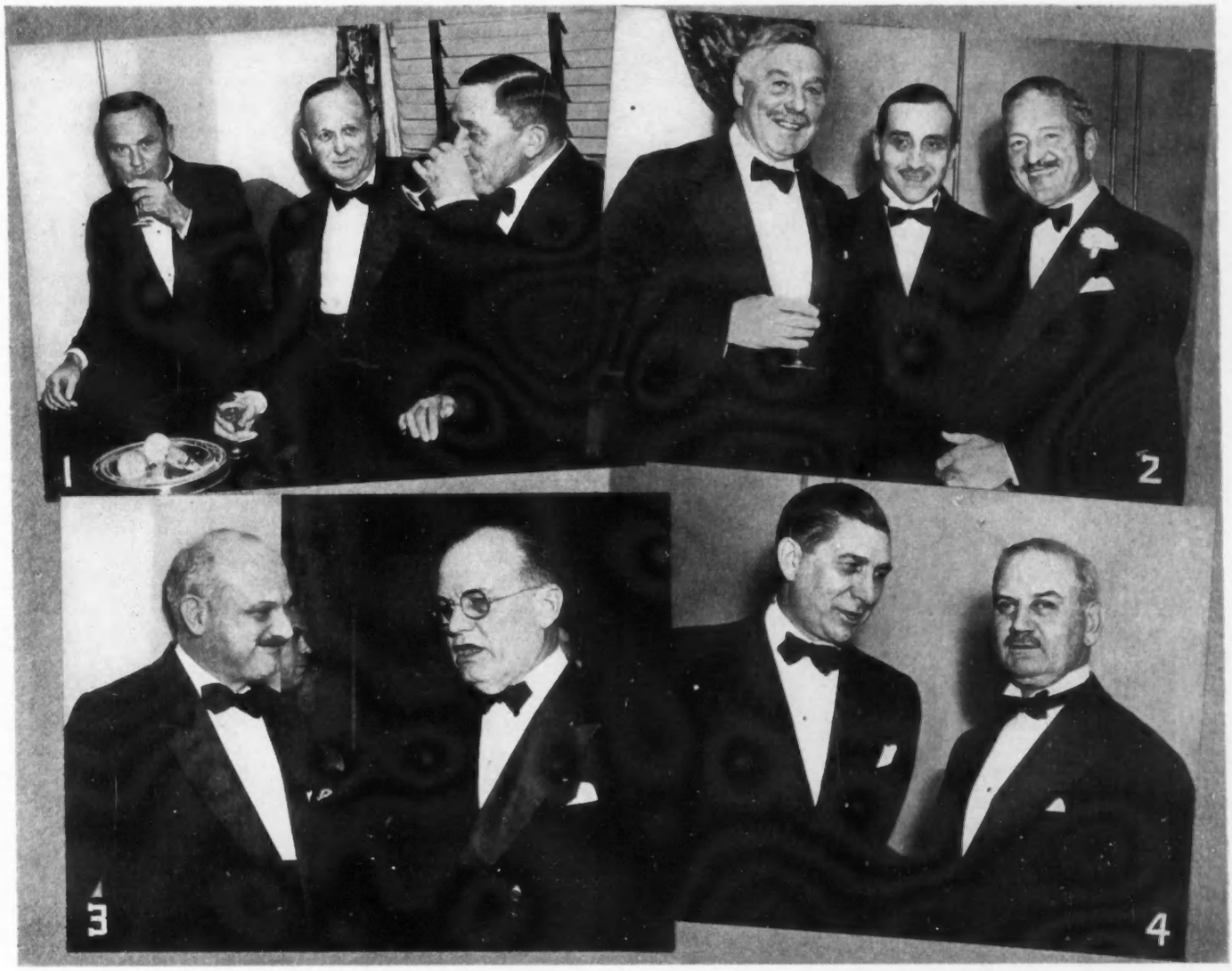
At the three Passenger Car Sessions widely different topics were introduced and discussed. In the first, devoted to the passenger-car engine, it was made evident that the formation of varnish and lacquer in internal-combustion engines has become one of the most important of the problems that beset the automotive industry. The "utter confusion" resulting from the constant stream of conflicting data, facts, and opinions, made many feel that this first symposium on a previously tabu subject was an outstanding success. Earlier in the same

Prominent Aircraft Executives at Dinner



Arthur Nutt, vice-president, Wright Aeronautical Corp.; Lieut. E. H. Beebe, aide to Major-Gen. Arnold; Dr. G. W. Lewis, director, aeronautical research, National Advisory Committee for Aeronautics; T. P. Wright, vice-president, Curtiss-Wright Corp.

Prominent Guests Gathered Before National Defense Dinner



1. B. C. Heacock, toastmaster, president, Caterpillar Tractor Co.; W. C. MacFarlane, president, Minneapolis-Moline Power Implement Co.; S. G. McAllister, president, International Harvester Co.
2. C. A. Dana, president, Spicer Manufacturing Corp.; George S. Piroumoff, president, Brockway Motor Co. Inc.; W. F. Rockwell, president, Timken-Detroit Axle Co.
3. Harold S. Vance, chairman of the board, Studebaker Corp.; George W. Borg, chairman of the board, Borg-Warner Corp.
4. H. J. Klingler, general manager, Pontiac Motor Division, General Motors Corp.; Alfred Reeves, vice-president and general manager, Automobile Manufacturers Association.

session was a colorful presentation of the progress and limitations in welded-steel cylinder blocks.

Passenger-car tires received full consideration at the second session wherein tire ratings, blow-outs, steering ratios, and the education of automobile engineers were among points of major interest.

In the last of the Passenger Car Sessions the subject of road noise led to discussion of the efficiency of noise meters, damping materials and resilient body mountings.

Symposium on Troubles from Varnish in Engines – **Presented by F. F. KISHLINE, Willys-Overland Motors, Inc., for the Passenger Car Activity Committee.**

AN effort to bracket and clarify the controversial and widely encountered problem of varnish in engines, is the purpose of this symposium, Mr. Kishline announces. This he does largely by presenting and interpreting the experience, opinions, and questions of many anonymous SAE members and their companies on this subject. These contributions, he explains, were received from a large number of representative sources, and present a typical cross-section of this phase of lubrication.

Mr. Kishline defines the offending "varnish" as a "synthetic resinous compound" precipitated by little known chemical reactions, oxidation, exposure of oil to relatively high temperatures, presence of foreign materials, or various combinations of these causes. Varnish has been blamed for a long list of engine troubles, he explains, among them sticking valves and rings, engine surges, blowby, and seizure.

Under the heading, "What To Do About It," the author concludes that varnish evidently is not partial to any particular engine design nor to any of the various combinations of design features that might seem logically to have some influence on the condition. It would appear that time and temperature are principal items in an engine which govern the condition, he says, and the temperature may or may not be the sump temperature. Possibly there is a critical temperature above or below which the formation is slight, he suggests, although one of the experiences contributed indicated varnish formation at temperatures up to 400 F.

Discussion

The type of lubricating oil has a profound effect on the formation of varnish, according to test results reported by W. A. Gruse and C. J. Livingstone, Mellon Institute of Industrial Research, in written discussion read by Mr. Livingstone. In one instance, he reported, replacing an SAE 40 paraffinic oil of high stability by a naphthenic oil of the same viscosity

grade produced a seized engine after 50 hr of operation under conditions which gave no noticeable engine deposits with the highly refined paraffinic oil.

We also found, he continued, that close piston clearances are not necessary to form lacquer, as we had no trouble in producing varnish at will with both close and loose clearances. With close clearances, however, he added, the trouble is more serious.

Six controlling factors in the early formation of varnish were named by Mr. Livingstone as: high crankcase oil and piston temperatures; oxidation of the lubricant; solvent power of the lubricating-oil medium; content of easily evaporated material in the oil medium; frequency of renewal of the crankcase oil and filter cartridge; and carry-over in the crankcase of sludge from a previous oil change.

The addition of oxidation inhibitors to low-quality oils will just prolong the agony as far as varnish-forming is concerned, Mr. Livingstone contended. All that can be expected from such inhibitors, they point out, is the avoiding of the chemical breakdown of the oil for a short time.

We believe that the use of high-grade lubricants which will not form varnish, with a reasonable recommendation for crankcase-oil change intervals by engine manufacturers, will eliminate a large part of the varnish and sludge problem, Mr. Livingstone concluded.

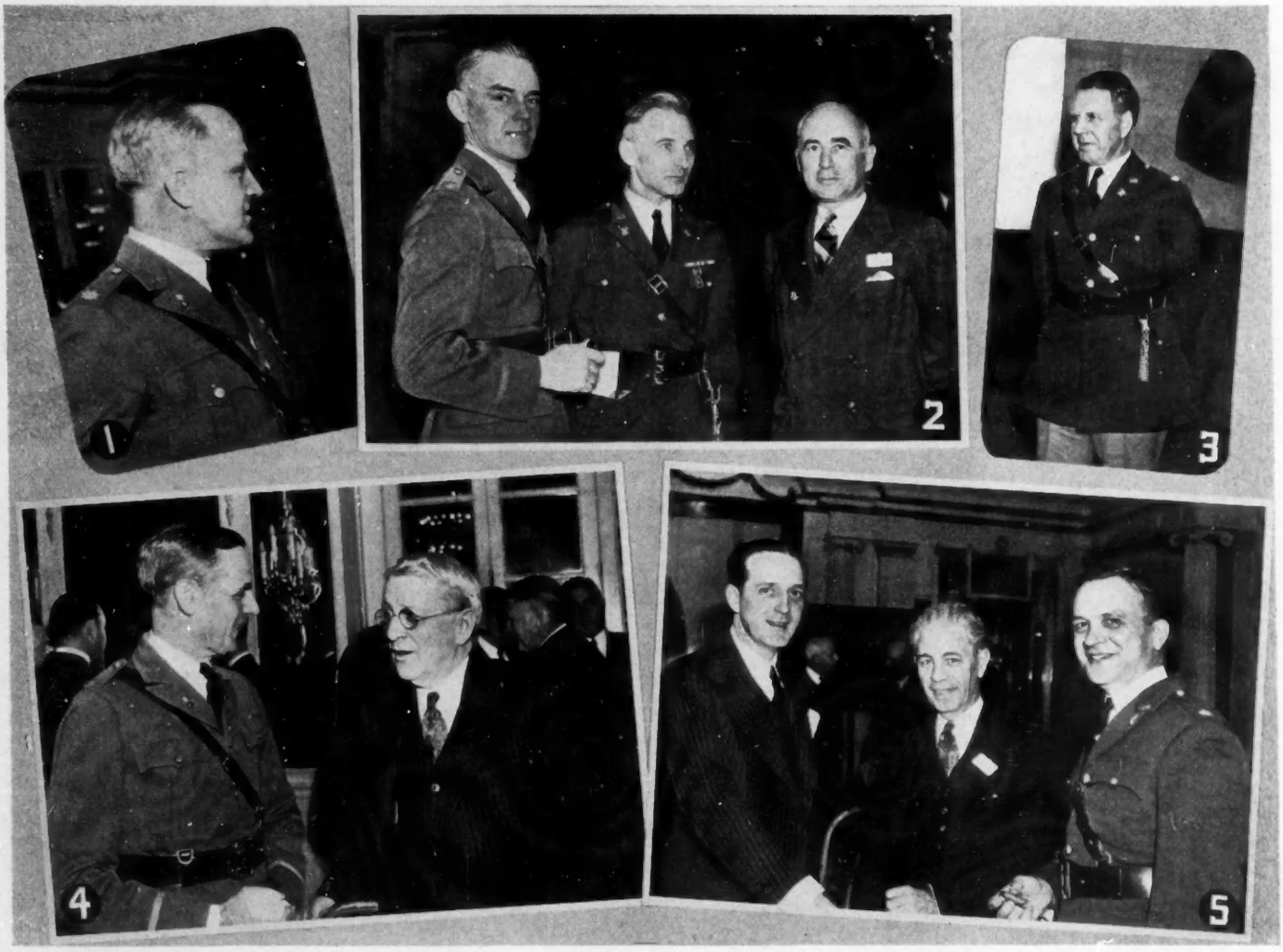
In supplementary discussion that referred more directly to Mr. Kishline's paper, Mr. Gruse and Mr. Livingstone expressed their beliefs that light volatile oils are more prone to lacquer formation than are heavy oils, and that, without the improvements made in refining during the past ten years, the lacquer problem would be much more severe today. We doubt whether real progress will be made, they warned, unless design engineers take seriously into account the chemistry involved in crankcase-oil deterioration.

An overflow attendance of more than 600 were given visual evidence of the authors' results by the projection of colored slides which clearly depicted the nature of the varnishes formed.

If we accept the words of a wise and learned gentleman that "no technical meeting is a success unless it results in utter confusion," then this meeting is very successful, noted William Harrigan of the Texas Co., referring to the wide differences of opinion expressed.

(*Continued on page 25*)

Active in National Defense Day Discussions



1. Major J. K. Christmas, Ordnance Dept.
2. Captain C. E. Jones, Quartermaster Corps; Major M. V. Brunson, Quartermaster Corps; Col. H. K. Rutherford, office of Assistant Secretary of War.
3. Lieut.-Col. James H. Johnson, Quartermaster Corps.
4. Major G. M. Barnes, Ordnance Department, and Col. H. W. Alden, chairman of the board, Timken-Detroit Axle Co., who was chairman of the Land Transportation Session.
5. Preston Tucker, American Armament Corp.; W. F. Beasley, Ordnance Dept., and Major W. W. Warner, Aberdeen Proving Ground.

Engineering for ... National Defense

THE United States has work to do on National Defense – plenty of it. And our military authorities know quite specifically what needs to be done, particularly by automotive engineers and executives.

Neither civilians close to preparedness needs, nor military men themselves are talking scare-headline generalities nor political sophisms. With high military officials and important industrialists and engineers gathered together, official statements, informal conferences and casual conversations throughout the 1939 SAE Annual Meeting all pointed in much the same direction. Our Country must perfect its organization industrially to back up its military establishments – just in case.

Nobody seems much worried about how far we may be behind the more militaristic European nations in armament – but many are a bit worried about relative efficiencies of organization for military ends. "The totalitarian states have set a mark in efficiency that may be hard for the democracies to equal" was a remark which symbolized an attitude running through many discussions.

The same idea is inherent in a recent statement about our air strength by Assistant Secretary of War Louis Johnson which 500 SAE men heard quoted: "We are falling behind in our development program. This lag is due to a loss neither of our inventive genius nor our skilled craftsmanship. It is due to our failure to give enough attention to the importance of a continuous program of research and development."

The required organization, moreover, means research and engineering as well as production organization, expert opinion made amply clear.

All three – research, engineering and production – need to be planned and coordinated vigorously and effectively – beginning now – if we are to maintain our position of being ready to defend ourselves adequately, come what may.

There is no disposition on the part of either high-ranking Army and Navy officers nor on the part of informed civilians to "get excited" about the current status of our military establishments, expressions throughout the SAE meetings indicated. The special National Defense Day itself which highlighted military affairs at this 1939 Annual Meeting did not in any way result from recent war-scares in Europe. As Col. H. W. Alden pointed out at the opening session of that day, the entire program was planned originally in June, 1938, long before the recent series of European crises had started.

There is, on the other hand, a clear recognition of certain facts about our relative preparedness position and a general belief that some of those facts need changing. Everybody agreed, for example, that Germany's air strength leads the world – one aircraft engineer recently back from Europe estimating that they have 5000 war planes ready for action; another that they have 10,000 planes in first-rate or near first-rate condition. Our War Department thought yesterday that its program of 2320 planes of all types by 1940 would be adequate for our needs. Now it is certain that we need many more for the Army alone. Considerable support was found around the sessions, however, for the view that it would be a mistake hurriedly to build 10,000 planes here, because the factor of obsolescence would probably render many of them worthless by the time they had been completed. Rather, steady, planned development of our air strength with assured manufacturing *capacity* for quick production in case of need was urged by most of the aircraft men.

Little was said about possible diesel-engine developments so far as war planes are concerned, although Capt. John Towers, assistant chief, Bureau of Aeronautics, U. S. Navy, indicated that a diesel might be preferable to a gasoline powerplant for Naval use *if* its performance, weight and fuel characteristics compared favorably. Both

★ ★ ★ ★ ★

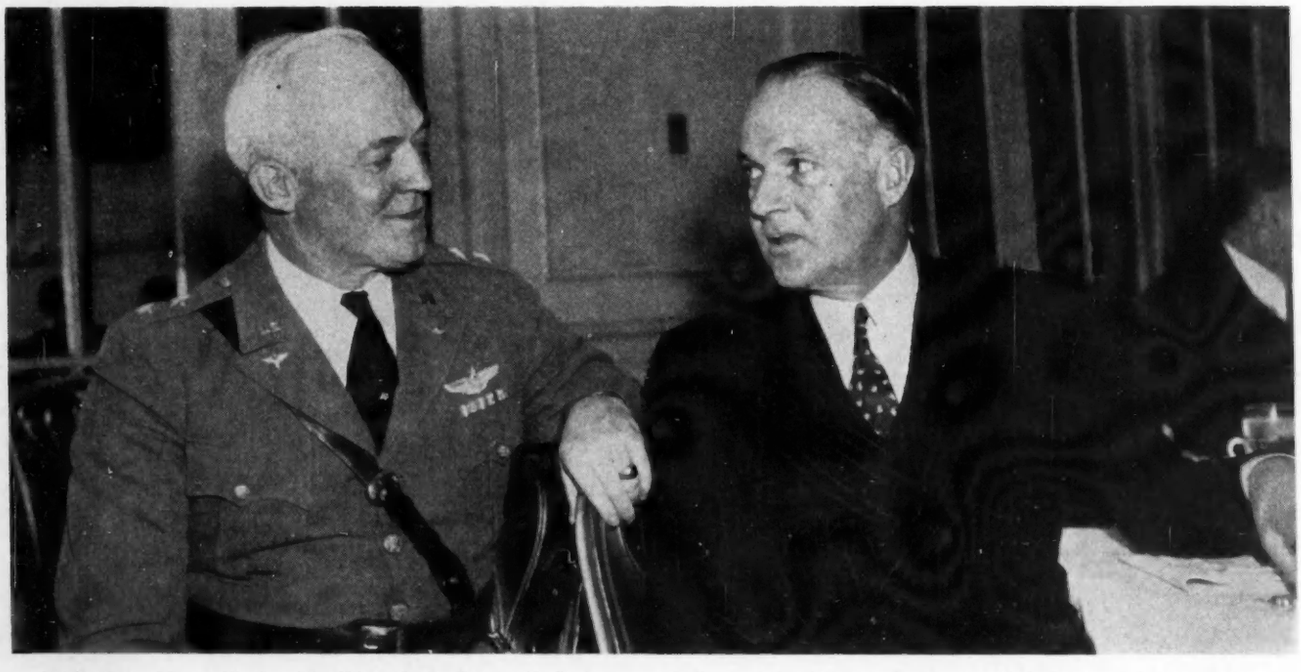
Capt. Towers and Major-Gen. Arnold, Army Air Corps Chief, however, made clear their belief that no such diesel is available. Major-Gen. Arnold, moreover, answered a question on this point by saying that his department is not interested in engines of less than 1000 hp and that he has yet to see a 1000-hp diesel for aircraft.

Our mechanized land-fighting vehicles, it was shown, finally have been acquired in sufficient numbers to permit proper maneuvers to develop the tactics of mechanized warfare. Delivery to the fighting elements of the Army of over $8,000,000 worth of tanks, scout cars, tractors, half-track vehicles, and other automotive ordnance in the last fiscal year was necessary to bring our forces to this status. The importance of maintaining at least such a force is emphasized by the fact that, contrary to general opinion, tactics must *follow*, not precede, the technical development of a new weapon, according to Major-Gen. Wesson, Chief of Ordnance.

The problem of modifying commercial vehicles to meet military requirements for cross-country service stands out as one important current problem so far as military transport is concerned. Quartermaster General Gibbons says the crux of the problem of obtaining satisfactory cross-country maneuverability lies in conversion of commercial two-wheel-drive vehicles, particularly of the light-weight, mass-production class, into four-wheel and six-wheel-drive types. "Our immediate peace-time need," he says, "is for four-wheel-drive ½ to 1½-ton payload capacity vehicles costing less than $1000." Some of our leading truck company engineers, however, feel rather strongly that this ideal is not entirely practical. Col. G. A. Green of General Motors Truck, for example, says that the changes required to switch from a production model to a four-wheel drive would cost at least half as much as the $1000 suggested by Major-Gen. Gibbons as the price for the whole vehicle. Col. Green suggests that a selected group of manufacturers be given a substantial order and that the Government supply – and retain ownership of – the required tooling. Bearing on this same subject, Col. A. W. S. Herrington, of Marmon-Herrington Co., contends that conditions within our industry today are totally different than those which had to be faced 23 years ago. Today, he points out, four manufacturing groups produce 92% of the Nation's trucks – which should greatly simplify production and standardization problems in case of a war emergency.

The immediate need for cooperation of industry in general and engineers in particular to perfect organization for National defense in our Democracy seems to be agreed upon by both military men and industrial executives alike. The extensive industrial mobilization plans which have already been prepared with industry's cooperation, Brig.-Gen. C. T. Harris, Jr., says, have as their chief objective reduction of the time lag which is inevitable in turning production from peace-time to war-time needs. And the vitality of efforts arising from the cooperation of well-developed individuals such as a democracy generates is emphasized by the statement of B. C. Heacock, Caterpillar Tractor Co. president, when he says:

"The industrialist, as an essential element in our National economy, can continue to generate and do all the business possible under whatever circumstances society prescribes. But, at the same time, he can also be an individual and a member of society and exert a mighty influence in shaping our circumstances. In performing well his double duty as a business functionary and a



Major-Gen. Henry H. Arnold, Chief of Air Corps, U. S. Army, and Capt. John Towers, Assistant Chief, Bureau of Aeronautics, U. S. Navy, were speakers at the Air Transportation Session.

citizen, he will be making his maximum contribution to National defense."

It is equally evident, from the attentiveness with which engineers from every branch of the automotive industry listened to the National Defense discussions, that the technicians are more than ready to do their part in essential preparedness developments. Their attitude is well summarized by the words with which SAE President W. J. Davidson closed his inaugural address at the National Defense Dinner.

"Twenty-odd years ago, our Society was called to do its part in service to its Country at a time of great stress. It responded actively – and effectively. When that crisis had passed, close relationships were maintained between the Society and our Country's military establishments. In times such as these in which we are living, the possibility of recall to active service must be recognized. Should that call come during my term of office or any other time whatever, the SAE will respond, as usual, in a way which is in accord with the high engineering skill and technical training which has so strongly characterized its peace-time achievements in the past."

The actual National Defense Day program took place on Wednesday, Jan. 11. High-ranking officers of the Army and Navy brought vividly and concretely to the engineers data about the present status of our armed forces, needs which remain to be met, and ideas about how automotive engineers can assist.

With unprecedented frankness problems facing the Army and Navy and of industrial mobilization for National defense were placed before the leading engineers and executives of the automobile and aircraft industries by Brig.-Gen. Richard H. Jordan, who read the paper prepared by Major-Gen. Henry Gibbins, Quartermaster General; Major-Gen. C. M. Wesson, Chief of Ordnance; Major-Gen. H. H. Arnold, Chief of Air Corps, U. S. Army; Capt. John Towers, Assistant Chief of Bureau of Aeronautics, U. S. Navy; and Brig.-Gen. C. T. Harris, Jr., Assistant to the Chief of Ordnance.

A short business meeting of the Truck, Bus, and Rail-car Activity preceded the first Defense Day Session. The Activity's nominating committee was elected.

The main points brought out in each of the important Defense Day papers follow:

National Defense Day

National Defense Dinner

B. C. Heacock, Toastmaster

Industrial Mobilization for National Defense – **BRIG.-GEN. C. T. HARRIS, JR., Assistant to the Chief of Ordnance, Chief of the Industrial Service.**

PEACE-TIME industry is geared to the production of peace-time needs, which are quite different than war-time needs – and to change over so that industry can produce war-time needs takes time, in some cases a year, Brig.-Gen. Harris states in opening his paper. It is for the purpose of reducing this time lag, he declares, that industrial mobilization plans are made.

The author emphasizes that all the plans that are being made, while designed for war are, in effect, determined efforts to maintain peace.

It is pointed out that the cost of maintaining in time of peace a full war reserve of material for a major emergency, even if such a thing were desirable, would be prohibitive from the standpoint of cost. The only other alternative, according to the author, is to be ready, through comprehensive planning, for the utilization of production by private industry after an emergency arises.

In brief, industrial mobilization is described as determining the capacity of industry to produce, and then apportioning this capacity equitably among the procuring agencies, including the Navy. If there is not enough existing capacity (plants in being) suitable for the purpose of meeting all essential needs, then plans are made for expansion or new construction. It is well to note, the author adds, that it is neither necessary nor desirable to allocate specific facilities to produce all of the requirements, as most of the material that is of commercial nature can be procured in time in the usual manner under competitive bidding. It is mainly for the technical items with no commercial counterpart, or where there is a shortage in capacity and serious procurement problems will be encountered that allocation is made, he explains.

One of the most vital agencies in the mobilization program, the author notes, is the Army and Navy Munitions Board, which is the connecting link between the Army and Navy. This agency, he explains, recognizes the co-equal requirements of both military services and insures consideration of both their needs in all plans. The current Industrial Mobilization Plan is the work of this board.

Before concluding his paper, Brig.-Gen. Harris states: "After many years of intimate contact with this work, I have never found American industry wanting either in its will to cooperate or its desire to perform."

Major-Gen. C. M. Wesson, Chief of Ordnance, presented a paper on military motor vehicles at the Land Transportation Session.

Land Transportation Session H. W. Alden, chairman

Military Motor Vehicles – The Problems of the Quartermaster Corps – **MAJ.-GEN. HENRY GIBBINS, Quartermaster General.**

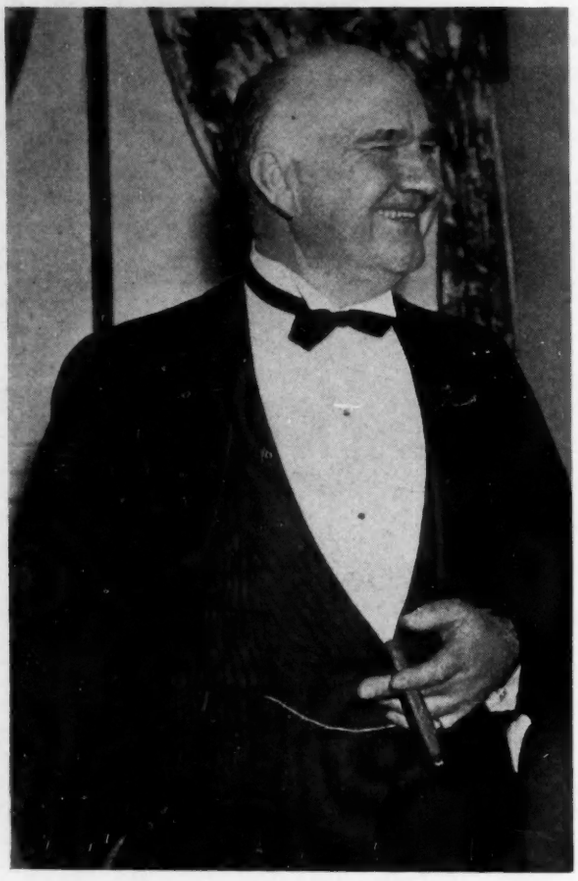
THE Quartermaster Corps, Major-Gen. Gibbins explains, is charged with the design, development, procurement, maintenance, storage, and issue of general-purpose vehicles of the Army. This is the motor transport of logistics, that is, of supply and movement of troops and equipments as differentiated from combat or fighting motor-vehicle equipment which is a responsibility of the Ordnance Department, he adds.

The author points out that there are certain fundamental truths to be faced in the problem of securing military motor vehicles in a war emergency, the most important of which are:

1. "That at the start of a war we must take the motor vehicles which the industry is then producing and which will most nearly meet military requirements.

2. "That certain military needs can only be met satisfactorily with vehicles having exceptional cross-country ability. However, production must not be delayed to secure these types. . . . The crux of the problem of obtaining satisfactory cross-country maneuverability, lies in the conversion of commercial two-wheel-drive

Dinner Speaker



Brig.-Gen. C. T. Harris, Jr., Assistant to the Chief of Ordnance.

vehicles, particularly of the light, mass-production class, into four-wheel and six-wheel-drive types.

3. "That a measure of standardization be secured as soon as possible for vehicles required in the combat zone in order to reduce the maintenance problem.

4. "That this standardization provide maximum interchangeability possible of assembly units between vehicles under conditions existing at the time.

"Our plans for procurement, modification, and standardization of commercial vehicles for general-purpose use in the military service are toward these ends," he declares.

Automotive Ordnance **– MAJ.-GEN C. M. WESSON, Chief of Ordnance.**

AUTOMOTIVE Ordnance, Major-Gen. Wesson states, covers generally automotive weapons – motor vehicles used primarily as fighting machines in battle and hence equipped with guns and protective armor plate. He notes particularly that it is a special and non-commercial phase of automotive engineering.

After describing the mission, personnel, means and procedure of the Ordnance Department, the author traces the development of the tank since 1918 and contrasts the modern 10-ton tank, which uses about 250 hp to propel it at speeds up to 45 mph while carrying a "payload" of armor, guns, ammunition, men, and equipment amounting to from 30% to 40% of its gross weight, with a 10-ton commercial tractor.

He explains that, when producing a tank, the Ordnance Department uses, wherever possible, commercially available components. When this cannot be done, he noted, a modification of a commercial component is used, and as a last resort a specially designed ordnance unit is used.

In summing up what is yet to be done, he declares: "We need to make the initial cost of our equipment cheaper so that it may be more widely used and may economically replace man-power in peace, as I am sure it can in war; we must increase the life of our equipment so that we can afford to train with it and not lose sight of the war-time benefits of mechanization by being blinded by the high peace-time cost; we need to make our equipment more readily producible in quantity in order that when M-day comes we may get fighting machines quickly, cheaply, and in quantity; we need the continuation of a sympathetic understanding and cooperation of the greatest automotive industry in the world, so that this industry may not only be a potential factor in the defense of America, but a dynamic factor as well."

In several parts of the paper the author pays tribute to the cooperative work of the SAE Ordnance Advisory Committee.

Air Transportation Session **T. P. Wright, Chairman**

Performance and Development Trends in Military Aircraft and Accessories **– MAJ.-GEN. HENRY H. ARNOLD, Chief of the Air Corps.**

THERE is continual battle within the Army Air Corps between the engineer, who is seeking perfection, and the tactical man, who demands airplanes in quantity, according to Major-Gen. Arnold. He notes that, as soon as a new airplane is being built in production quantities, something better always appears.

The author, in discussing modern trends in military aircraft, points out that the air phase comes first in warfare and that the air forces must be in being and at full strength on the day that war occurs, ready to strike against the agencies of the enemy which are most vital to him in preparing his campaigns. This condition explains, he continues, the increasing emphasis on long-range, great-size, heavy bomb loads, and employment of multiple engines for power. He also notes that present wars have stressed the importance of fighting airplanes.

Looking ahead Major-Gen. Arnold sees high-altitude flying; slower landing speeds; improved aerodynamic cleanliness of design; more powerful engines; and extended use of synthetics for rubber and silk, of plastics, of stainless steel, and of spot welding. The trend in propellers, he believes, is toward twin double-rotation propellers for small high-speed planes and giant propellers of light metals or wood for big planes. Hollow steel, hollow dural, magnesium, and plastically impregnated wood, all seem to be possibilities for use in developing light blades, he believes.

In concluding, the author quotes from a speech by the Hon. Louis Johnson, Assistant Secretary of War, in which he stressed the need of doubling, tripling, or even quadrupling the size of our air forces and the importance of experimental development.

Mutual Problems of Military and Civil Aviation in the Field of Air Transportation **– CAPT. JOHN TOWERS, Assistant Chief, Bureau of Aeronautics.**

THE most significant advances in aircraft design in the last two decades, according to Capt. Towers, are the increase in wing-loading, the advent of the multiengined airplane, the NACA cowl and nacelle-in-wing, and the stressed-skin airplane of today. He points out the problems that have attended the introduction of each of these improvements in performance.

The author also discusses operating problems which have come with the use of higher-octane fuels and longer operating ranges; problems of position-fixing and of radio communication. He also speaks of carburetor icing and of a non-icing carburetor developed by the Naval Aircraft Factory.

After commenting upon the cooperation of commercial airlines in solving many of the complex problems of aircraft maintenance, Capt. Towers lists some of the problems in maintaining naval aircraft that are being faced today. He discusses corrosion, inspection of metal parts, and the use of aluminum-alloy rivets requiring no heat-treatment. He also stresses the necessity of standardization of aircraft-engine parts and accessories.

The author urges the development of an American sleeve-valve type engine which, he feels, has inherently greater reliability due to the large reduction in parts and higher output due to the elimination of a red-hot exhaust-valve-head from the combustion chamber of the engine.

Brig.-Gen. Richard H. Jordan, Office of Quartermaster General, who read the paper prepared by Major-Gen. Gibbins, Quartermaster General.

OFFICERS *for* 1939

President W. J. Davidson

THE SAE President for 1939 is W. J. Davidson of General Motors Corp. He has been affiliated with that organization in technical capacities since 1914, except for the War period, and recently has taken office as general sales manager of its new Diesel Engine Division.

During the World War he served in France with the Motor Transport Corps, United States Army, being commissioned captain before his discharge in 1919. The French Government honored Mr. Davidson in 1934, awarding him the Cross of the Legion of Honor in recognition of his war service and of friendly cooperation with French engineers since the War.

A native of Montreal, Canada, Mr. Davidson speaks French fluently. He was educated at McGill University, graduating with a degree of Bachelor of Science in Mechanical Engineering. Prior to entering the Army he served two years in the general engineering department of the Cadillac Motor Car Co.

After his discharge Mr. Davidson was made chief engineer of the Canadian Products Division of GMC at Walkerville, Canada, subsequently going to Oshawa as technical director of General Motors of Canada, Ltd. In 1923 he was appointed to the staff of Alfred P. Sloan, Jr., then president of GMC, and made executive secretary of the General Technical Committee. It was under this committee that the General Motors Proving Ground was built and first operated. In 1926, Mr. Davidson was also made executive secretary of the newly formed New Devices Committee of the Corporation. He was named business director of General Motors Research Laboratories in 1930 and, before his assignment to the Diesel Division, was technical director under R. H. Grant, vice-president of GMC in charge of sales.

Treasurer Beecroft

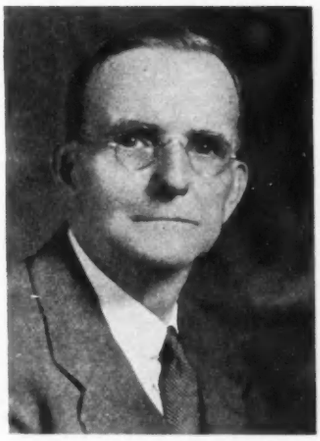
Mr. Davidson became a member of the Society in 1926 and had served one year of a two-year term on the SAE Council when he was elected president. Since 1929 he has been active on many SAE technical and administrative committees. When the Engineering Relations Committee was formed in 1935, he was selected as its first chairman, serving for two years in this capacity. Earlier he had been chairman of the Constitution Committee. He also has represented the SAE on several American Standards Association Sectional Committees.

As a member of the Council last year, Mr. Davidson was active in organizing and planning for the SAE World Automotive Engineering Congress which will take place from May 22-June 8.

Retiring President C. W. Spicer, and Harry T. Woolson, who was president of the Society in 1937, will serve on the 1939 Council.

David Beecroft will serve his seventh consecutive term as SAE treasurer during 1939.

Upon his election as president, Mr. Davidson resigned his position of councilor-at-large and, at the first meeting of the 1939 Council in Detroit on Jan. 13, F. K. Glynn was elected a councilor to complete Mr. Davidson's unexpired term. *(See p. 41.)*



Past-President Spicer

Past-President Woolson

Vice-Presidents

1. H. K. Cummings (M '27) takes office as vice-president representing the Aircraft-Engine Engineering Activity. He is chief of the automotive power plants section of the National Bureau of Standards. After receiving his B.S. degree in chemistry from Worcester Polytechnic Institute in 1910, Mr. Cummings attended Cornell and Chicago Universities (receiving his M.S. degree in physics from the latter), and was a fellow at Clark University. During this period he was also on the faculty of the New York State School of Clayworking and Ceramics, and instructor in engineering physics at Worcester Polytechnic. From 1917 to 1921 Mr. Cummings served in the United States Army as lieutenant in the Ordnance Department. Following his discharge he was research physicist for Acheson Graphite Co. for a short time before taking an instructorship at Brown University. In 1922 he joined the Bureau of Standards, advancing to his present position in 1927. Active in SAE functions, Mr. Cummings has served on the Aircraft-Engine Activity Committee since 1930 and as its vice-chairman in 1938. He also holds long membership on the Crankcase Oil Stability, Fuels Research, and Ignition Research Committees, and is SAE representative to the American Documentation Institute.

2. William Littlewood (M '36), vice-president, engineering, American Airlines, Inc., serves as vice-president representing the Aircraft Engineering Activity. Cornell University granted him his M.E. degree in 1920. Immediately afterwards he joined the Niles-Bement-Pond Co., and later the Ingersoll-Rand Co. where he advanced to assistant chief inspector for the Phillipsburg and Easton plants. From 1927 to 1930, Mr. Littlewood was production manager of the Fairchild-Caminez Engine Co., and general manager of its successor, the Fairchild Engine Corp. He joined American Airways, Inc., in 1930 as engineer; later becoming chief engineer of its successor, American Airlines, Inc. He was advanced to his present position in January, 1937. Mr. Littlewood was awarded the Wright Brothers Medal for his paper "Operating Requirements for Transport Airplanes," presented at the 1935 SAE Annual Meeting. He is a member of the Society's Aircraft Activity Committee, Aircraft-Engine Activity Committee, Aircraft-Engine Lubricants Research Committee, and vice-chairman of the Chicago Section representing its aircraft activity. He is also vice-president of The Institute of the Aeronautical Sciences.

3. John S. Erskine (M '19), 1939 vice-president representing the Tractor and Industrial Power Equipment Engineering Activity, is engineer, allied industrial equipment, International Harvester Co. He is a graduate of the University of Michigan, and has been in the employ of the Harvester Co. since 1911, with the exception of five years, during and after the War. While with the Harvester company he has held various positions, such as assistant chief engineer of tractor design, assistant chief engineer of stationary engine design, 10 years as chief research engineer of the gas power laboratory at the tractor works, and two years in charge of special tractor engineering. He took his present position last year. In 1928 Mr. Erskine represented the Chicago Section on the Sections Committee, and he has held membership on the tractor and equipment division of the Standards Committee since 1936. Last year he was vice-chairman of the Tractor and Industrial Power Equipment Activity Committee.

4. A. G. Marshall (M '31) heads the Fuels and Lubricants Engineering Activity as vice-president. He is manager of the technical applications department for the Shell Oil Co. located at Martinez, Calif., and has been affiliated with that company since he came to this country from England in 1928. From 1920 until 1928 he was research chemist with the Asiatic Petroleum Co., Ltd., London, and earlier had held a similar position with Messrs. Ricardo & Co. Mr. Marshall received his M.A. degree from New Zealand University; was elected Rhodes Scholar and attended Balliol College, Oxford University, where he received the B.A. degree. An active member of the Northern California Section, he served as its chairman during the 1936-1937 Section year. Mr. Marshall has been a member of the Fuels and Lubricants Activity Committee since 1934, representing it on the Meetings Committee in 1937; a member of the lubricants division of the Standards Committee for the past two years; and, last year, a member-at-large of the Sections Committee and a member of the oils division of the Extreme-Pressure Lubricants Research Committee.

5. Carl J. Bock (M '20), elected 1939 vice-president of the Truck, Bus and Railcar Engineering Activity, is truck division engineer, General Motors Truck & Coach Division of Yellow Truck & Coach Mfg. Co. He has been affiliated with this organization since 1924 when he joined the engineering department of Yellow Coach Mfg. Co. He served as assistant chief engineer of that company and in 1926 became truck division engineer of the General Motors Truck Co. He took his present position in 1930. Before joining Yellow Coach, Mr. Bock served in several engineering capacities with the Ordnance Department of the War Department. Previously he had been with the Holt Mfg. Co., which he joined in 1926 after completing three years of mechanical engineering at Iowa State College. Mr. Bock has been a member of the motor truck division of the SAE Standards Committee, the Motor Truck

Representing SAE Activities, 1939

and Motorcoach Rating Committee, and is an alternate on the Ordnance Advisory Committee.

6. John G. Wood (M '11) becomes 1939 vice-president representing the Passenger Car Engineering Activity. Mr. Wood is assistant chief engineer of the Chevrolet Motor Division of General Motors Corp. His affiliation with General Motors began some twelve years ago when he gave up his position as president and general manager of the Allied Magnet Wire Corp. to become executive engineer of the Olds Motor Works. During 1930-1931 he was general manager of the Muncie Products Division; returning to Olds as chief engineer in 1932. He joined the Chevrolet Motor Division 1933. Mr. Wood took his first position in the automotive industry after receiving his B.S. degree from Purdue University in 1907. It was with the National Motor Vehicle Co. He returned to Purdue for his M.E. in 1910. Later he held executive posts with the Empire Motor Car Co., Remy Electric Co., and Midwest Engine Co., prior to joining the Allied Magnet Wire Co. in 1924. Mr. Wood is a member of the Passenger-Car Activity Committee and a past-treasurer of the Indiana Section.

7. F. G. Shoemaker (M '20), who takes office as vice-president representing the Diesel-Engine Engineering Activity, is chief engineer of the Detroit Diesel Engine Division of the General Motors Corp. After receiving his B.S. degree in electrical engineering from the University of Illinois in 1914, Mr. Shoemaker was for four years foreman of a garage he had worked in while attending college. Since then he successively held positions as instructor in airplane engines, United States Army School of Military Aeronautics, University of Illinois; experimental engineer, the Buda Co.; associate mechanical engineer, Materiel Division, United States Army Air Corps; and research engineer, H. H. Franklin Co., before joining General Motors in 1929. With that organization he was research engineer and assistant head of the powerplant section before being named head of the diesel engine section. He took his present position last year. Mr. Shoemaker was a member of the Diesel Engine Activity Committee and its representative on the Society's Meetings Committee last year. He also was a member of the diesel-engine division of the Standards Committee.

8. H. O. Mathews (M '31), vice-president representing the Transportation and Maintenance Engineering Activity for 1939, is automotive engineer with the Public Utility Engineering & Service Corp. He is an alumnus of Purdue University, receiving his B.S.E.E. degree in 1923 and his professional degree of Electrical Engineer in 1927. Starting with the Bell Telephone System in 1923, he served in various capacities in the plant department until December, 1930. At that time he was made superintendent of the automotive department in Chicago. He continued in that capacity until he took his present position in 1936. Mr. Mathews is vice-chairman of the Chicago Section and in 1937 represented the Section on the Meetings Committee. For several years he has served on the T&M Activity Committee, last year as vice-chairman; the transportation division of the Standards Committee; and the operators' division of the Extreme-Pressure Lubricants Research Committee.

9. William B. Hurley (M '32) heads the Production Engineering Activity as vice-president. He is staff engineer, sales department, Detroit Edison Co. After receiving his degree of Bachelor of Chemical Engineering from University of Michigan in 1911, Mr. Hurley joined the Frost Gear & Forge Co. as chemical and metallurgical engineer. After two years with that company he affiliated with the Midvale Steel Co., advancing to manager of the bar steel department and superintendent of the crucible plant and rolling mills. During the War years, 1917-1919, he was a major in the Ordnance Department, United States Army, in charge of the gun plant at Watertown Arsenal. In 1917 he was a member of the United States Airplane Mission to England, France and Italy. From 1919 to 1931 he was with Dodge Brothers in various capacities, becoming operating manager of the Truck and Bus Division of Chrysler Corp., after that company took over the Dodge interests. He joined the Detroit Edison Co. in 1932. Mr. Hurley served on the SAE Iron and Steel Committee from 1916 to 1919. More recently he has been a member of the Production Activity Committee, serving as its vice-chairman in 1937 and 1938, and its representative on the Meetings Committee since 1936. Last year he was chairman of the production division of the Standards Committee and a member of the General Standards Committee.

10. I. L. Carron (M '29) takes office as vice-president representing the Passenger-Car-Body Engineering Activity. He is a body engineer with the Dodge Division of the Chrysler Corp. Mr. Carron has been affiliated with the Chrysler organization since 1925, serving first as checker and later as assistant chief draftsman in the body engineering department. He took his present position last year. He is also an instructor in body design in the Chrysler Institute of Engineering. Before joining Chrysler, he was draftsman with the Ford Motor Co. Mr. Carron graduated from the Technical School for Auto Body Designers and later received his L.L.B. from the Detroit College of Law. He has represented the Passenger-Car-Body Activity on the Meetings Committee and last year was the vice-chairman of Body Activity of the Detroit Section as well as a member of the Passenger-Car-Body Activity.

1939 SAE Councilors

1. A. L. Beall (M '24) research engineer, Wright Aeronautical Corp., has been elected to serve on the Council for the next two years. He has been affiliated with the automotive industry since 1911 when he was junior engineer with the H & N Carburetor Co. Since then he has held technical posts with the Prest-O-Lite Co., Inc., Automotive Electric Service Corp., Westinghouse Union Battery Co., and the Vacuum Oil Co. With the latter company he was in charge of quality control of internal-combustion-engine fuels, and a member of its research committee. He has been affiliated with the Wright Aeronautical Corp. since 1933. Mr. Beall served as SAE vice-president representing the Aircraft-Engine Engineering Activity in 1937. He has been chairman of the SAE Meetings Committee, chairman of the Membership Committee, vice-chairman of the Fuels and Lubricants Activity Committee, chairman of the Ignition Research Committee and secretary of the Metropolitan Section. During 1938 he served on eight committees and was one of three SAE representatives on the American Standard Association's sectional committee for petroleum products and lubricants.

2. Burton J. Lemon (M '23), general development and new products department, U. S. Rubber Products, Inc., will continue on the Council this year. After graduating from Cornell University with an A.B. degree in 1908, he was an instructor in analytical chemistry at the University until 1915. During this period he received his Ph.D. in chemical engineering. From Cornell he joined the U. S. Rubber Co. as assistant to director, general laboratories. Since then, with the exception of the War period, when he was commissioned as captain, Motor Transport, United States Army, he has been with U. S. Rubber. For a number of years he was field engineer, tire development division, in Detroit. He was transferred to New York as technical representative, tire division, U. S. Tire Co., in 1933, and was made tire engineer in 1934. He has been in the general development and new products department since last year. Mr. Lemon served as chairman of the Detroit Section in 1929, has been a member of the General Research Committee since 1926 and was chairman of the Front-Wheel Alignment Committee from 1931 to 1937. Last year he represented the Washington Section on the Meetings Committee and held membership on several technical committees.

3. Lawrence J. Grunder (M '27) will continue on the Council this year. He is automotive engineer for the Richfield Oil Corp., Los Angeles, responsible to the vice-president and general manager of sales on all fuel problems. He has been affiliated with Richfield since 1932. A graduate of the California Institute of Technology, class of 1929, he continued his studies at Pennsylvania State College as a fellow in lubrication research, the following year. Before entering college and during summer vacations he added to his engineering education by working in the fuels section of the City of Los Angeles Engineering Department testing laboratories, as towerman for the Southern California Edison Co., inspector for the Regan Forge & Engine Co., and draftsman with Burns & Lewis, mechanical engineers. After his year at Penn State he was automotive research engineer with Hughes Development Co., Los Angeles, before joining Richfield. Mr. Grunder is a past-chairman of the Southern California Section and has been the Section's representative on the National Sections Committee since 1936. He also has held membership on the Society's House Committee and Fuels and Lubricants Activity Committee.

4. W. E. McGraw (M '34), chief engineer, Chrysler Corp. of Canada, Ltd., becomes a member of the Council for a two-year period. While still an undergraduate, he left Michigan State College to join the Maxwell Motor Car Co. as designer in 1913. During the next ten years he advanced to chief draftsman and assistant chief engineer. In 1923, when Chrysler interests took over the Maxwell Co., Mr. McGraw became engineer, production contact, with the Chrysler Corp. He went to Canada as export engineer and chief engineer of the Chrysler Canadian Division in 1934. Since 1935 he has represented the Canadian Section on the Sections Committee. After serving as vice-chairman of the Section for two years, he was elected Section Chairman for 1937-1938. In 1936 he was a member of the House Committee.

5. George Leonard Neely (M '35), elected to the Council for 1939-1940, is a graduate of the United States Naval Academy at Annapolis, Md. He entered the Navy as an ensign and served in that capacity from 1922 to 1925. In the latter year he joined the research staff of the Standard Oil Co. of Calif., where he is now research engineer in charge of fuels and lubricants. Mr. Neely has been active on SAE technical committees for a number of years, participating in this work even before becoming a member of the Society. He has been the Northern California Section's representative on the National Sections Committee a number of times. He now holds membership on the National Advertising Committee, the Fuels & Lubricants Activity Committee, the Aircraft-Engine Lubricants Research Committee, the Crankcase-Oil Oiliness Research Committee, the Crankcase-Oil Stability Research Committee, the Oils Division of the Extreme-Pressure Lubricants Research Committee, and the lubricants division of the Standards Committee. Mr. Neely is also 1938-1939 Chairman of the Northern California Section.

WORLD'S LEADING ENGINEERS JOIN IN S. A. E. CONGRESS

Tentative Program Covers Wide Range of Automotive Interests; Thirty Foreign Societies Invited

SIXTY TECHNICAL PAPERS, amplified with hundreds of prepared discussions by the world's leading automotive engineers, combined with elaborately planned tours of the nation's greatest automotive manufacturing factories, will be offered by the Society of Automotive Engineers, sponsor of the 1939 WORLD AUTOMOTIVE ENGINEERING CONGRESS, May 22 to June 8.

The CONGRESS will be an across-the-continent event, giving members of the SAE and their guests the finest opportunity ever offered to learn about and see the newest developments in all phases of automotive design, manufacture, and operation.

Overseas participation in the technical sessions will be an outstanding feature of the CONGRESS, offering engineers in the aircraft; automobile; truck, bus, and railcar; tractor; fuels and lubricants; transportation, and other allied fields, the widest interchange of new ideas ever proposed in the industry's history. Official invitations to more than thirty technical societies in fourteen countries, as well as the governments themselves, have been issued by the Society.

The Tentative Program, just announced, embraces the widest possible range of automotive engineering. The speakers listed on the following pages are only a few of the important engineers and engineering executives who have been invited to present papers. Many more have already tentatively accepted invitations to write papers, and a large number of others will contribute prepared discussions.

You can travel across the country by air liners, railroad, buses or private automobiles. Make arrangements through your local office of the American Express Company.

1939 WORLD AUTOMOTIVE ENGINEERING CONGRESS of the S.A.E.

SOCIETY OF AUTOMOTIVE ENGINEERS

HEADQUARTERS ADDRESS: 29 WEST 39th ST., NEW YORK

NEW YORK · INDIANAPOLIS · DETROIT · SAN FRANCISCO

MAY 22 TO JUNE 8 SET FOR CONGRESS

New York, Indianapolis, Detroit and San Francisco Will Greet SAE Delegates At Time Of 2 Great World's Fairs

Engineering history will be made during the SAE World Automotive Engineering Congress, May 22 to June 8. Foremost authorities in automotive engineering and related sciences from the leading nations of the world will join SAE members in this great Congress which will convene in New York, Indianapolis, Detroit, and San Francisco. Sixty technical sessions will be combined with tours of the nation's giant automotive plants, attendance at America's greatest automobile race, sightseeing trips of engineering and general interest, and visits to World's Fairs in New York and San Francisco. SAE Sections in the four key cities of the Congress will act as hosts to American and foreign delegates.

Technical sessions on passenger and commercial motor vehicles, aircraft and aircraft engines, and their fuels and lubricants have been designed to contribute to the world's store of automotive engineering data. Because of the huge attendance expected, it will be necessary to limit certain of the events to members of the SAE, applicants for membership, members of related Societies in other countries, and specially named representatives of foreign governments.

NEW YORK

From Monday, May 22 until Sunday, May 28 the Congress will make its headquarters at New York's Hotel Pennsylvania. Foreign delegates will be welcomed at the International Session, Monday morning. That afternoon a five-day series of important technical sessions begins. The first international dinner of the Congress will be held Friday evening; a leader of American industry is to be the speaker. Wednesday has been designated as "World Automotive Engineering Day" at the New York World's Fair in honor of the visitors.

During the five days of technical sessions, special programs have been arranged for wives and families of the delegates. There are no formal plans for Saturday and Sunday. However, arrangements are being made for visits to many of the points of interest in the metropolitan area, including the Empire State Building tower, the National Broadcasting Co. station, a television demonstration, and an inspection trip of the highway and traffic engineering accomplishments which have sped up the vast flow of automotive traffic in and about the city. On this latter trip the vehicular tunnels under the Hudson River, the new George Washington and Triboro Bridges, and elevated highways in New York and New Jersey are among the developments to be seen.

In New York the Metropolitan Section of the Society, headed by its chairman, M. C. Horine, will be hosts to the delegates.

On Sunday evening, May 28, members of the Congress are to board a special air-conditioned train for Indianapolis at New York's Grand Central Station.

INDIANAPOLIS

Arriving at Indianapolis Monday morning, May 29, the delegates will be welcomed by members of the Indiana Section, of which Macy G. Teetor is chairman.

Interest at Indianapolis will center on the 500-Mile International Sweepstakes. The special train, which will serve as a hotel during the stay is to be stationed at a siding adjacent to the speedway. Members will have ample opportunity on Monday to visit the track where they can inspect the racing cars and the pits. They also will attend the drivers' instruction meeting and meet some of the internationally famous racing pilots.

Monday evening the special train will taxi the members back to Indianapolis in order that the group may attend the big Pre-Race Dinner, which is being planned by the Indianapolis Section. At the close of the dinner the train will return to the Speedway.

After an early breakfast on Tuesday morning Memorial Day the delegates will leave their traveling hotel for the Speedway where a special block of excellent seats near the starting line has been reserved.

(Continued on Page 4)

HENRY FORD, *who joined the SAE in 1905, sent an application which reads "No. 2," and who is one of the founders of the Society, heads the Advisory Board of the SAE World Automotive Engineering Congress.*

SAE WORLD LEADERS ON ADVISORY BOARD

Henry Ford, one of the founders of the Society, heads the Advisory Board for the SAE World Automotive Engineering Congress. Serving with him are leading American and foreign automotive executives.

Working closest with Mr. Ford are the following men who are serving as Division Advisors:

Lord Austin, K.B.E., Chairman, Austin Motor Co., Ltd., England; E. G. Budd, President, Edward G. Budd Mfg. Co.; Ugo Gobbato, General Manager, Alfa Romeo, Italy; Maurice Gossland, President, Carbureter Sales, Vyzuce, Rear Admiral R. E. Land, Chairman, United States Maritime Commission; Glenn L. Martin, President, Glenn L. Martin Co.; S. G. McAllister, President, International Harvester Co. of America; R. E. Olds; Alfred P. Sloan, Jr., Chairman, General Motors Corp.; Count Alfred von Soden, Director, Daimler-Benz A.-G., Germany; and Orville Wright.

(Continued on Page 4)

60 TECHNICAL SESSIONS AND 4 BIG DINNERS

Plant Inspection Trips and Speedway Visit Head Technical Features

Every professional activity of the Society is represented in the 60 technical sessions scheduled for the SAE World Automotive Engineering Congress.

The two-week program, now being whipped into final shape by the National Meetings Committee with Ralph R. Teetor, general chairman, and the Activity Committees, promises important papers on automotive engineering problems that are being faced wherever motor vehicles, aircraft or tractors are being built or operated. Authorities from this country and abroad will discuss their views on these subjects.

SAE Activities to sponsor sessions during the five-day technical meeting in New York (May 22 - 26), are: Aircraft; Aircraft Engine; Fuels & Lubricants; Passenger Car; Passenger-Car Body; Transportation & Maintenance; Truck, Bus, & Railcar; Diesel Engine; and Tractor & Industrial Power Equipment. Two of the three T & M sessions will be devoted to public utility problems.

While no technical session is scheduled during the Congress visit to Indianapolis (May 29 - 30), interest will concentrate on the mechanism of the cars which will participate in the 500-Mile International Sweepstakes.

In Detroit (May 31 - June 2), delegates will attend a session arranged by the Production Activity, as well as visit some of the huge automobile plants.

During the final days of the Congress in San Francisco (June 6 - 8), technical sessions will be under the auspices of the SAE Aircraft, Transportation & Maintenance, Fuels & Lubricants, and Diesel Engine Activities.

(Continued on Page 4)

THIS NEWSPAPER (left) contains many details about the 1939 WORLD AUTOMOTIVE ENGINEERING CONGRESS of the SAE. If you have not received a copy, or would like one sent to a friend in this country or abroad, please notify SAE Headquarters immediately, at 29 West 39th Street, New York, N. Y.

RALPH R. TEETOR (below) Chairman of the SAE National Meetings Committee, is heading up the technical and general plans of the CONGRESS.

1939 WORLD AUTOMOTIVE

OF THE SOCIETY OF

(Tentative Technical

NEW YORK *(Headquarters, Hotel Pennsylvania)* MAY 22-28

MONDAY, MAY 22. Opening Session; one Passenger Car; one Fuels & Lubricants and one General Session.

TUESDAY, MAY 23. General Session; one Passenger Car; one Transportation & Maintenance, and two Fuels & Lubricants Sessions.

WEDNESDAY, MAY 24. One Fuels & Lubricants; one Passenger Car Body; one Tractor, and two Public Utility – T. & M. Sessions.

THURSDAY, MAY 25. General Session; two Aircraft Engine; and two Truck, Bus & Railcar Sessions.

FRIDAY, MAY 26. A Congress Dinner, two Aircraft Sessions, and two Diesel Engine Sessions.

The CONGRESS will open **Monday morning, May 22**, with the **INTERNATIONAL SESSION, Ralph R. Teetor,** chairman, SAE Meetings Committee, general chairman; **M. C. Horine,** chairman, Metropolitan Section, chairman. Speakers: **W. J. Davidson,** president, SAE, and **Alfred Reeves,** vice-president and general manager, Automobile Manufacturers Association. **FUELS & LUBRICANTS SESSION: T. B. Rendel,** Shell Petroleum Corp., chairman. "Relation of Diesel Fuel Properties to their Engine Performance," **W. S. Mount** and **G. A. Hope,** Socony-Vacuum Laboratories. **PASSENGER CAR SESSION: J. C. Zeder,** chief engineer, Chrysler Corp., chairman. "Composite Frame and Body Construction and Related Problems," **Walter D. Appel,** foreign liaison engineer, General Motors Corp. "Hydraulic Torque Converters," **Professor Wilhelm Spannhake,** Karlsruhe, Germany. **GENERAL SESSION: Dr. T. G. Delbridge,** president, ASTM, and director of research, Atlantic Refining Co., chairman. Speaker, **A. E. Dunstan,** chief chemist, Anglo-Iranian Oil Co., Ltd., London, one of the world's foremost authorities on petroleum. **FUELS & LUBRICANTS SESSION: B. E. Sibley,** chief technologist, Continental Oil Co., chairman. "Measuring Lubricating Oil Quality," **Professor H. A. Everett,** Pennsylvania State College. Prepared discussion on tests made with small single-cylinder engines in the laboratory by at least six outstanding petroleum authorities. "Engine Deposits, Field and Laboratory," **J. P. Stewart** and **B. W. Story,** Socony-Vacuum Oil Co. **PASSENGER CAR SESSION: J. G. Wood,** vice-president, SAE, chairman. "Developments of Small British Automobiles," engineering executive, British automobile manufacturer. "Laboratory Measurements of Steering Properties of Tires," **Dr. A. W. Bull,** United States Rubber Co. **FUELS & LUBRICANTS SESSION: W. M. Holaday,** Socony-Vacuum Oil Co., chairman. "Laboratory Tests as a Means of Evaluating Engine Performance," **Dr. F. L. Miller,** in charge of lubricants and lubrication research, Standard Oil Development Co., and **Dr. R. W. Richardson,** Standard Oil Development Co. "Underwood Oxidation Test and Its Correlation With Service," **H. C. Mougey,** chief chemist and assistant technical director, General Motors Corp. research laboratories. **TRANSPORTATION & MAINTENANCE SESSION: T. C. Smith,** engineer, American Telephone & Telegraph Co., chairman. A paper discussing the comparative performance of gasoline, Diesel, and Hesselman engines by an authority on all these types. **FUELS & LUBRICANTS SESSION: A. G. Marshall,** vice-president, SAE, chairman. "Evaluation of the Fuel Test and Proposals for Its Formulation," **Dr. Ing. A. von Phillippovich,** Deutsche Versuchsanstalt fur Luftfahrt, Berlin. **PUBLIC UTILITY – T. & M. SESSION: T. L. Preble,** supervisor, automotive transportation, Tide Water Associated Oil Co., chairman. "Fleet Use of Small Passenger Cars and Half-Ton Trucks," **H. O. Mathews,** Public Utility Engineering & Service Corp. The paper deals primarily with fleets operated by the public utilities for supervising their properties and maintaining their equipment. The discussion will center on economy in operation and maintenance. **PASSENGER CAR BODY SESSION: I. L. Carron,** Chrysler Corp., chairman. "Body Engineering – Past, Present, and Conjecture as to the Future," E. L. Allen, Jr., Standard Products Co. **PUBLIC UTILITY – T. & M. SESSION: H. O. Mathews,** vice-president, SAE, chairman. "Millions of Miles of Road Test Service," a synopsis of factual data on carefully controlled road tests of the latest models of small cars, emphasizing findings in respect to safety factors, design, and economy of fuels and lubricants, by **William Harrigan,** engineer, Texas Co. **TRACTOR SESSION: John S. Erskine,** vice-president, SAE, chairman. "Track-Type Tractors' Contribution to Economic and Social Progress," **B. C. Heacock,** president, Caterpillar Tractor Co. "Automotive Engineering in Agriculture Mechanization," **W. C. MacFarlane,** president, Minneapolis-Moline Power Implement Co. These papers will be followed by an unusual sound film, "Building a Nation," produced especially for the CONGRESS by the Farm Equipment Institute under the auspices of the Tractor & Industrial Power Equipment Activity of the SAE. It will show the present wide range uses of tractors in developing the national resources of the United States, and also in construction and industrial applications. Introduction by **Harry**

ENGINEERING CONGRESS

AUTOMOTIVE ENGINEERS

Program)

G. Davis, director of research, Farm Equipment Institute. **AIRCRAFT ENGINE SESSION: Arthur Nutt,** vice-president in charge of Engineering, Wright Aeronautical Corp., chairman. "European Comments on High Output Engines," **Dr. Ing. W. P. Ricart** and **Dr. Ing. Sandro Sirtori,** Alfa Romeo Co., Milan, Italy. "High Output Aircraft Engines," **E. W. Hives,** Rolls-Royce, Ltd., Derby, England. **TRUCK, BUS, & RAILCAR SESSION: Carl Bock,** vice-president, SAE, chairman. "Weight Reduction Through the Use of Ferrous Materials," **Colonel E. J. W. Ragsdale,** chief engineer, Railcar Division, Edw. G. Budd Mfg. Co., "Weight Reduction Through the Use of Non-Ferrous Materials," **Frank Jardine,** chief engineer, Castings Division, Aluminum Co. of America. These two papers will present up-to-the-minute information on the engineering applications of these two classes of material to reduce commercial vehicle weight. **AIRCRAFT ENGINE SESSION: H. K. Cummings,** National Bureau of Standards, chairman. "Propeller and Engine Vibration Stress Problems," **Erle Martin,** chief engineer, Hamilton Standard Propellers. **TRUCK, BUS, & RAILCAR SESSION: M. C. Horine,** Mack Mfg. Corp., chairman. "Power Transmission on Buses," **Colonel G. A. Green,** vice-president, General Motors Truck Co., a discussion of the whole field of this development and its outlook. **GENERAL SESSION:** "Composite Aircraft," **Major R. H. Mayo,** Imperial Airways, London. A discussion of the "pick-a-back" aircraft. **AIRCRAFT SESSION: William Littlewood,** vice-president, SAE, chairman. "Flight Testing of Large Transport Airplanes," **Ed Allen,** Stearman Aircraft Co. "Advantages of Three-Engine Aircraft," **G. Gabrielli,** Fiat Aero Division, Italy. "Transatlantic Flight," **Dr. R. J. Nebesar,** chief engineer, Avia, Czechoslovakia. **DIESEL SESSION: F. G. Shoemaker,** vice-president, SAE, chairman. "Recent Developments in Diesel Lubricating Oils," **George L. Neely,** Standard Oil Co. of Calif. **AIRCRAFT SESSION: Professor Peter Altman,** University of Detroit, chairman. "Use of Magnesium Alloys in European Automobile and Aircraft Industries," **Dr. H. Altwicker,** I. G. Farbenindustrie, Bitterfeld, Germany, and **Mr. Menking,** American Magnesium Corp. **DIESEL SESSION: P. E. Biggar,** executive engineer, General Motors Truck Corp., chairman. "Single-Plunger Multi-Cylinder Fuel Injection Pump," by an engineer, Hesselman Motor Co., Sweden. "British Automotive Diesel Practice," **Professor S. J. Davies,** Kings College, London. **DINNER: C. F. Kettering,** vice-president, General Motors Corp.

INDIANAPOLIS *(Headquarters, Air-Conditioned Train)* MAY 29-30

MONDAY, MAY 29. Inspection visit to the Speedway, pits, etc. Attendance at race drivers' meeting. **DINNER:** Pre-Race Dinner for the CONGRESS at the Columbia Club, Indianapolis. Macy O. Teetor, chairman, Indiana Section, SAE, chairman. Captain E. V. Rickenbacker, president, Eastern Air Lines, toastmaster; D. G. Roos, vice-president, Willys-Overland Motors, Inc., speaker.

TUESDAY, MAY 30. Attendance at the **500-Mile International Automobile Sweepstakes;** a special section in the grandstands will be reserved for members of the CONGRESS.

DETROIT *(Headquarters, Hotel Statler)* MAY 31, JUNE 1-2

WEDNESDAY, MAY 31. W. B. Hurley, Detroit Edison Co., Chairman. Inspection trip to the Ford Motor Co., visiting Greenfield Village, Dearborn Museum, the Rotunda, housing Mr. Ford's historical exhibit of road transportation vehicles from their infancy, and the River Rouge Plant.

THURSDAY, JUNE 1. Joseph Geschelin, Detroit technical editor, Chilton Co., chairman. Inspection trip to the Chrysler Corp.: Plymouth Motor Co. factory, including the final assembly line; Chrysler Highland Park plant and engineering laboratories. **DINNER:** International Dinner: R. N. Janeway, chairman, Detroit Section, SAE, chairman. K. T. Keller, president, Chrysler Corp., toastmaster. William S. Knudsen, president, General Motors Corp., speaker.

FRIDAY, JUNE 2. Inspection trip to General Motors Proving Ground and laboratories. Members and guests will be taken over the test roads by the G.M. engineering and test staff. **PRODUCTION SESSION: A. J. Schamehorn,** director, G. M. Proving Ground, chairman. "What Is New in Heat Treating Methods, Materials, and Processes," **E. F. Davis,** chief metallurgist, Warner Gear Co., and vice-chairman, Iron & Steel Division, SAE Standards Committee. "Developments in Malleable Iron Practices and Their Automotive Applications," **Enrique Touceda,** consulting engineer, and a leading authority on malleable practices, and **J. H. Lansing,** Malleable Founders Society; a full description of the latest advances in "short malleable" practice.

(Continued on Next Page)

1939 WORLD AUTOMOTIVE ENGINEERING CONGRESS

OF THE SOCIETY OF AUTOMOTIVE ENGINEERS

(*Tentative Technical Program*)

SAN FRANCISCO *(Headquarters, Hotel Fairmont)* JUNE 6-8

TUESDAY, JUNE 6. Opening Session; Public Utility – T. & M.; Transportation & Maintenance; and General Session.

WEDNESDAY, JUNE 7. Aircraft Engine; Diesel Engine; and a Session on Big Airplanes.

THURSDAY, JUNE 8. Two Fuels & Lubricants Sessions, and International Dinner.

OPENING SESSION: Tuesday, June 6, George L. Neely, chairman, Northern California Section, SAE, chairman. **PUBLIC UTILITY – T. & M. SESSION: H. W. Drake,** chairman, Northwestern Section, general chairman; **S. B. Shaw,** Pacific Gas & Electric Co., technical chairman. "Engineering Maintenance," **R. E. Rowley,** Los Angeles Dept. of Water and Power. **TRANSPORTATION & MAINTENANCE SESSION: J. Verne Savage,** Portland, general chairman; **E. W. Templin,** Los Angeles Department of Water and Power, technical chairman. "Bearings: From Design to Maintenance," **A. B. Willi,** chief engineer, Federal Mogul Corp. **GENERAL SESSION:** "Sub-Stratosphere Flying," **D. W. Tomlinson,** Transcontinental & Western Airlines. **AIRCRAFT ENGINE SESSION: C. E. Stryker,** Bendix Aviation, Ltd., general chairman; **E. E. Wilson,** senior vice-president, United Aircraft Corp., technical chairman. "Aircraft Engines and Their Lubrication," **Arthur Nutt,** vice-president in charge of engineering, Wright Aeronautical Corp. "European Aircraft Engines and Their Fuels," **F. R. Banks,** Ethyl Export Corp., London, **DIESEL SESSION: C. G. A. Rosen,** engineer in charge of Diesel development, Caterpillar Tractor Co., general chairman. **F. G. Shoemaker,** vice-president, SAE, technical chairman. "The Rôle of the Diesel," a symposium in three parts – 1. "Trucks," 2. "Aircraft," by **F. W. Achterberg,** Junkers Corp., Dessau, Germany; 3. "Railroads," **A. R. Walker,** Illinois Central Railroad. **BIG AIRPLANES SESSION: William Littlewood,** vice-president, SAE, and chief engineer, American Airlines, Inc., technical chairman. Paper, **A. E. Raymond,** Douglas Aircraft Co., Inc. **FUELS & LUBRICANTS SESSION: A. G. Marshall,** vice-president, SAE, general chairman; **Dr. D. P. Barnard,** associate director of research, Standard Oil Co., Ind., technical chairman. "Fuels and Lubricants," a symposium composed of eight papers and prepared discussions covering a wide range of problems. Speakers include **A. E. Becker, A. J. Blackwood, Dr. G. H. Cloud, T. A. Boyd, Neil MacCoull,** and **J. R. Sabina. FUELS & LUBRICANTS SESSION: L. J. Grunder,** Richfield Oil Corp., general chairman; **Ralph R. Teetor,** vice-president in charge of engineering, Perfect Circle Co., technical chairman. "Wear of Crankshafts with Copper-Lead Bearings," **C. G. Williams,** director of research, Institution of Automobile Engineers, London. "Piston Ring Wear," **P. S. Lane,** American Hammered Piston Ring Co.

INTERNATIONAL DINNER: George L. Neely, toastmaster.

WATCH The SAE JOURNAL for additional details about the 1939 CONGRESS. ALL MEMBERS will be sent further announcements from time to time. Please SEND NAMES of your friends who may be interested in the program to SAE headquarters.

MAKE Airplane, railroad, steamship, bus, hotel and other travel arrangements with YOUR LOCAL American Express Co. office or agency – in the United States or abroad.

SOCIETY OF AUTOMOTIVE ENGINEERS, 29 West 39th St., New York, U. S. A.

1939 SAE Annual Meeting

(*Continued from page 16*)

This varnish formation in engines is costing the motoring public large sums because the increased friction causes fuel waste, he pointed out. Because of the increased output and improved volumetric efficiency of modern engines, better engine oils must and shall be made available, Mr. Harrigan contended. Because of volumetrically improved engines, he explained, the boundary layer of exhaust or spent gases that remain in the combustion chamber is reduced, and the oil is subjected to higher temperatures and, to withstand this greater heat, we are now forced to "insulate" the motor oil. Time, temperature, and rate of oil flow are the principal factors in the varnish problem, he specified. From my observation there is not a 1939 engine used in passenger-car service that will not cause "non-insulated" engine oils to varnish under normally severe driving conditions, he concluded.

"Are we sure that our varnish troubles are entirely due to lubricating oil?" asked Prof. H. A. Everett, Pennsylvania State College, after recalling an experience where diesel fuel was the cause of "the most beautiful lacquer coating that I have ever seen."

It does seem that, in certain instances, some of the varnish found on the pistons and rings may come from fuel, Mr. Kishline remarked in answer to Prof. Everett's question. To support his statement he told of comparative tests on two identical engines in which varnishing occurred in the one operated with a low mixture temperature.

The co-author of the first discussion, Mr. Gruse, joined the debate at this point and revealed that all the tests reported by Mr. Livingstone were made with natural gas as a fuel.

I do not think that we could assume that natural gas could be considered as a contributing factor in the formation of lacquer, he remarked. It is our belief, he continued, that the bulk of the lacquer as we know it comes from the lubricating oils, or at least from the fuel via the lubricating oil.

Taking sharp issue with the assumption made by Mr. Gruse that natural gas as a fuel does not contribute to varnish formation, another discusser recalled an experience with a convertible engine that could run either as a diesel or natural-gas engine. I have seen these same engines, he reported, running on natural gas and as diesels on the same load and with the same lubricating oil, stick rings in 600-700 hr on natural gas, and have no trouble at all running as a diesel.

Although interesting, in my opinion, these remarks prove nothing, was Mr. Gruse's blunt reply. It is entirely possible for the engine to run as a diesel, and have the fuel wash the rings clean, he explained; we have seen it happen many times.

At this point Chairman Paton drew attention to several conclusions to be drawn from Mr. Kishline's paper which, he feels, cannot be escaped. The first one, he said, is that there are differences in engines – some are more susceptible to certain types of disturbance than are others. These disturbances, he explained, may show up as coked rings, corroded bearings, or as sludge or varnish formation. His other conclusion is that, in the engines which are the most susceptible to varnish, there are good and bad oils.

It seems logical to me, contributed A. A. Lane, Gulf Research & Development Co., that, instead of asking for super-premium oils at higher prices in the design of the low-priced car, the car should be designed down to a low-priced oil.

Varnishing is no respecter of price class, from the evidence that we have gathered, Mr. Kishline replied. The immediate problem, he stated, is to design ourselves out of this trouble, regardless of the price of the oil.

Summarizing the results of considerable testing on the sludge and varnish problem at Chevrolet, A. W. Jackson of that company, concluded that sludge and varnish are caused by such conditions as: too infrequent oil changes; a chemical change in the lower-cost oils; and changes in the oils by reworking at the refinery so that natural inhibitors are removed. It is our firm conviction from recent tests, he announced, that oils can be made which will give no engine operation troubles. Commenting on Mr. Lane's suggestion, he recommended that engine builders give the low-priced car buyer better oil economy by giving him more miles per gallon of good oil.

The importance of oil quality on the varnish and sludge problem was again emphasized by H. C. Mougey of the Research Division of General Motors, who displayed slides of comparative tests to confirm his conclusions.

"We have found that, when you lick one trouble, you sometimes land over in another patch of cockle burrs," contributed B. E. Sibley, Continental Oil Co. He told of experiments in which they finally got the pistons running clean, but found that it had been at the cost of excessive corrosion and wear of the wristpins and wristpin bushings caused by additions or changes in the lubricating oil. He also reported that certain makes of engines operating in the oil fields that burn a fuel on the order of propane have been giving trouble by forming lacquer.

G. L. Neely, Standard Oil Co. of Calif., concluded the session by reading a paragraph from Mr. Kishline's paper in which he points out that engine design must change and that fuels and lubricants will change with them as they have in the past.

Welded Steel Cylinder Blocks – **EVERETT CHAPMAN, Lukenweld, Inc.**

A SERIES of slides and informal discussion telling what has been done in the development of large welded-steel cylinder blocks, comprised Mr. Chapman's presentation. The basic things that can go wrong in making these welds were emphasized. The possibility of introducing severe stress concentration resulting in fatigue failure, because of lack of fusion at one point in the welded joint, was pointed out with the aid of examples and stress-concentration diagrams. He showed how plastic upset loosens joints, and gave examples of good and bad structures.

Discussion

"How can you specify a weld so that you'll be sure to get a good one?" was the first of a barrage of questions fired at Mr. Chapman.

Except for the ASME boiler code, you'll have to depend upon the reputation of the welder, Mr. Chapman replied; authoritative standards of workmanship are sadly lacking. Of course, he reminded, the X-ray can be used as a check. "A pile of freight cars at the bottom of a hill," he reported, "is too often the first sign of bad welds in railroad work."

Our welding problems are different because our work is lighter and we are not trying to develop the ultimate strength of the material, explained D. W. Sherman, A. O. Smith Corp. We have found that welded cylinder blocks cost as much or more per pound than do cast blocks, he reported, thus making the choice of construction dependent on the weight to be saved, if any, by the welded construction.

Bakelite models under stress were used to obtain the stress-concentration diagrams displayed and the effect is obtained by double refraction, Mr. Chapman explained to another discusser.

Asked whether he knew of any development work on small welded-steel cylinder blocks, Mr. Chapman replied that he had heard only of scattered efforts, some of which had failed. A complete fabricating overhaul is necessary to weld the small blocks, he believes, and good design is all-important, the essence of which is distribution of material in an attempt to reduce weight. We are now welding cylinder blocks for Navy auxiliaries as small as 300 hp, he announced. Mass-production methods will help a lot, he said, recalling that his costs came down 300-400% when production of railway underframes was stepped up to 10 per week.

I can understand that the technique of welding is a production problem, commented Walter T. Fishleigh, consulting engineer, but the proper design of members is the problem that is critical to us as engineers. To get some of this design information, Mr. Fishleigh asked Mr. Chapman to sketch the fundamental shapes of several typical welds necessary to produce a joint that will have the ultimate strength of the parent metal. This sketching he did. One important limitation in making these joints, Mr. Chapman revealed, is that both sides of the joint must be accessible.

A 25% weight saving using small welded-steel cylinder blocks over those of cast iron, assuming the same rigidity, was Mr. Chapman's conservative estimate of the possibilities of this construction. His statement was made in answer to a question by J. B. Macauley, Jr., Chrysler Corp.

A short business session followed in which a Nominating Committee for the Passenger Car Activity was selected.

Designing the Tire for the Car – **E. A. ROBERTS, Firestone Tire & Rubber Co.**

A NEW method of rating passenger-car tires is suggested by the author in which horsepower as well as load is used as a governing factor. Tires rated by this method, he believes, will give more nearly equal service on all makes and models of automobiles. Horsepower of the car, he explains, was felt to be the factor most likely to be representative of the acceleration, cruising speed, and top speed of the vehicle.

Mr. Roberts' paper presents a comprehensive review of tire design and development. Functional units of a tire are taken up one by one – body plies, tread plies, cushion, bead wire, reinforce, chafers, sidewall, and tread. Fundamental factors that affect tire service are discussed, such as load, inflation, speed, and atmospheric temperature, as well as neglect, abuse, horsepower, and road surface. The author also considers the various types of tire failures; a graphic method of measuring tread movement; tire development and improvement; costs; and tailoring the tire to the car.

Pneumatic Tires as They Should Be Engineered for Our Future Cars – **W. S. JAMES, Studebaker Corp., and P. C. ACKERMAN, Chrysler Corp.**

THE marked increases in tire mileage during the past ten years, the authors point out, indicate that one of the dreams of the automotive engineer may come true – that the tire will last the life of the car and the spare tire will be eliminated.

Tire improvement, the authors conclude, should be made along the following lines:

1. A further increase in mileage through reduced tread wear.
2. Reduction in tire noises commensurate with the noise reduction in the rest of the car.
3. An improvement in the "cornering power" of tires.
4. A reduction in the porosity of the tubes.

The authors also believe that rolling resistance of tires has increased with the use of larger sections, and that this item might receive more attention from the tire manufacturers in the interest of improved fuel economy. Types of tire failures, such as tread wear, blowouts, and punctures are discussed as to causes and cures. Wheel tramp, shimmy, and wheel wobble are taken up in relation to front-end instability. The effect of tires on steering effort, cornering power, tire noise, side-skidding, and braking effort and traction, are other topics discussed.

Discussion

The desirability of rating passenger cars on a combination of loading and horsepower, as proposed in the paper by Mr. Roberts, was questioned by W. E. Shively of Goodyear, on the ground that the benefits are not worth the added complication. He pointed out that, in passenger cars, horsepower is related to weight and that consequently load ratings provide an index of both weight and power. B. J. Lemon of U. S. Rubber endorsed Mr. Shively's views on this suggestion.

On the suggestion in the James-Ackerman paper, that the tire industry should help to increase the automotive engineer's tire knowledge, Mr. Lemon said that it would be helpful to standardize terms used to describe tire failures, etc, better and, if that were done, both engineers and the public would have a better understanding. On temperature effects, Mr. Lemon said that vehicle design is important, illustrating his point by reference to certain streamlined buses on which the rear wheels are so enclosed that very little air can get at them. He also said that the effect of temperature on tread wear seems to vary in different countries. Referring to blow-outs, he stated that there are no accurate statistics available and emphasized that we should try to find out whether the tire failed before or after the accident.

Commenting on the objectives listed in the James-Ackerman paper, Capt. R. D. Evans of Goodyear said that anything that is done to improve cornering is offset by poorer performance in some other direction. Larger tire sections, he said, improve cornering and this improvement is more noticeable under limiting conditions and on rough roads. The trend to smaller rim diameters, he continued, is reducing cornering power without any compensating gains in other directions. Tire engineers, he said, are anxious to reduce rolling resistance because it produces heat, but that, for improvement in this direction, we would have to look to the development of improved materials.

Regarding whether front or rear blow-outs are more dangerous, a question on which Messrs. James and Ackerman disagreed, Capt. Evans said he agreed with both of them. He cited a survey of drivers which showed a similar disagreement indicating that it depends on the design of the car, circumstances, and so on.

Orrel A. Parker, Parker Wheel Co., asked how serious a blow-out is, either front or rear. Mr. Roberts said almost any driver can control a car at 50 mph, that at 60 mph some can, but that, at 70 mph, it takes an expert, explaining that available maneuvering space is a factor. Ernest Wilson of General Motors gave a different answer, stating that his experience indicated that 50 mph is the most dangerous speed, adding that a leaking tire perhaps is more dangerous than a blow-out. Mr. Lemon told of test at 70 mph which showed a maximum pull of 8 in. and that rear blow-outs are harder to control than front. W. E. England asked if blow-outs are as serious a hazard, relatively, as advertised.

E. B. Neil of N. W. Ayer expressed the view that high steering ratios increase difficulties of control and the possibilities of reducing ratios without making parking more difficult should be investigated. Mr. Neil also suggested that educational efforts include information on controlling cars under these conditions.

Capt. Evans mentioned the dangers of braking after a blow-out and said that one driver had told him that the second swerve after a rear tire failure is more dangerous than the first – which Capt. Evans indicated is due to over-correction on the first swerve.

Mr. James said that, in the suggested instructions, it might be well to point out that good steering is often a better way to get out of danger than using the brakes. On steering ratios, he said, his experience indicates that the ratio itself is not so important as whether the driver is accustomed to the ratio. He said that both test and race drivers require considerable time to adjust themselves to a new ratio whether it is higher or lower than the one they have been using.

Mr. Ackerman said that in one year they increased the ratio on one car and reduced it on another and on both models the

result was improved handling. Consequently, he said that we can not generalize that changing ratios always produces a result in the same direction as other factors are involved.

J. H. Booth of Buick asked about the effect of speed on the tire hysteresis loop. Mr. Shively said that the area decreases with speed, disappearing at about 50 mph, although the effect is not eliminated as it appeared as a drag like braking.

Passenger Car Road Noise – **E. E. WILSON and PAUL HUBER, General Motors Proving Ground.**

THE authors introduce their paper by outlining the various sources of noise existing in the motor car, together with some of the suppression means. Noise measurement, test methods, and the mechanism of the transmission of forces generated by the contact between the tire and the road to the body and frame are discussed. The authors state that, since these forces produce motion and deflection of the body, they are responsible for the road noise, and conclude that the proper approach to a method for suppressing road noise is through the structural design of the vehicle.

They suggest, in the main, the localizing of stress to stress members, the raising of the resonant frequencies of the structure, the detuning of the suspension system, the body, and the frame, together with some isolation at selected points.

Discussion

The authors' comments on the accuracy of noise-measuring instruments, on the effectiveness of damping materials, and on resilient body mountings, stimulated most of the discussion of their paper.

Pointing out that the authors do not state explicitly what they regard as a reasonable tolerance on sound measurements, Dr. E. J. Abbott, Physicists Research Co., presented a table which showed that a tolerance of 2 db or 1 db is worthless or nearly worthless; of 0.5 db usable; of 0.25 db practical; and of 0.1 db desirable, but very difficult to maintain.

Discussion by James C. Zeder, Chrysler Corp., read by Chairman Keys, reported that a decrease in rough road noise of as much as 2 db has been effected by the application of suitable damping materials to the car floor in road tests of cars equipped with resilient body mountings. When these body mountings were not used, the reduction in noise was not so great, Mr. Zeder noted. That a good sound-deadening material is effective was also maintained by F. A. Firestone in discussion prepared with his colleague P. H. Geiger of the University of Michigan.

John S. Parkinson of Johns-Manville stated, in comments read by the chairman, that manufacturers of sound-control materials will, in general, agree with what the authors have to say about the function of sound-damping materials. These materials, he contends, have a definite usefulness in the car, but have suffered from the fact that manufacturers have expected too much from them.

It is the hope of G. T. Stanton, Electrical Research Products, Inc., that the paper will provide a foundation for the acceptance by the automotive industry of acoustical engineering principles.

A "ripping" discussion was given by R. F. Norris, president of Norris Industries, Inc. Tearing up his discussion, page by page, and reading none of it, Mr. Norris gave humorous, but sound, comments on the paper.

Larry Ball suggested that acoustical engineers of the industry get together and work out a calibration for noise meters that they all can use. Tore Franzen, Chrysler, spoke of the close relationship between friction break-away and noise, which should not be overlooked.

Agreeing with the authors that reduction of tread mass, the air, and side-wall elasticity of tires would decrease noise, E. S. Ewart of U. S. Rubber said that tire engineers are working on the problem and expect improvement.

The co-author, Paul Huber, took the floor briefly to state that deadening materials are undoubtedly beneficial, but that they work more on localized impacts. He has not been able to get 2 db reduction by using it, he stated.

Camera Contest Winners!!

When automotive engineers take their candid cameras in hand, they forget all about slide rules and service troubles and become interested in almost anything in the world. The more than 60 entries in the first SAE Photographic Contest showed this clearly by including as subjects everything from babies and skylines to sunsets and swans.

On display in the rear of the main meeting room throughout the 1939 Annual Meeting, these contest entries were viewed with interest by more than 2500 members and guests. Prizes were awarded by a board of judges under the chairmanship of Stephen J. Zand, himself a leading cameraman of the Society. Others on the board of judges were: Peter Altman, R. F. Norris and R. M. Cleveland. The awards were:

	1st Prize	Honorable Mention
Group A – SAE Activities	*Tore Franzen* ("Silhouette")	*Tore Franzen* ("Candid of Kettering")
Group B – Industrial	*C. W. MacMillan* ("Ancient Counterpoise")	*H. J. White* (No title)
Group C – Home	*R. Szymanowitz* ("Whee")	*H. Rabezzana* ("Herbie Kalmar" and "Curly")
Group D – Pictorial	*L. Ochtman, Jr.* ("Winter Afternoon")	*R. Szymanowitz* ("Skyline")
Group E – SAE Summer Meeting	*H. Rabezzana* ("Idyll")	*H. C. Hunter* ("Wheel of Industry")

Passenger-Car Body Session

F. S. Spring, chairman

Interest in foamed latex and mobile air conditioning brought the attendance of this session to the overflow mark. Before the technical session was called to order by Chairman F. S. Spring, I. L. Carron, Passenger-Car Body Activity vice-president for 1939, presided at a business meeting wherein members of the Activity's nominating committee were elected.

While we have tried to improve riding comfort by using shock absorbers, improving spring suspension, and so on, seats until recently have been left about where they were in the horse-and-buggy days, Mr. Spring stated in introducing Mr. Ellies, the first speaker, whose paper was preceded by the showing of a motion picture of the fabrication of foamed latex.

The Development of Foamed Latex Cushioning – **E. E. ELLIES, Airfoam Division, Goodyear Tire & Rubber Co.**

PRESENT comfort requirements and design trends, Mr. Ellies contends, have created new demands in passenger-car seating. He points out that the natural qualities of foamed-latex cushioning augur its consideration in meeting these seating problems.

Mr. Ellies' discussion includes a review of the various applications of this material in the transportation industry. He also describes the properties of foamed latex.

Discussion

In discussion it was pointed out that one of the big factors in favor of the new product, when used as a seat cushion, is its lightness. The author reported up to 50 lb saving between a full foamed-latex cushion and a complete conventional seat including springs and pad.

Direct questions by Tore Franzen, Chrysler Corp., as to comparable cost of a full foamed-latex cushion and a conventional one, were parried by the author, who declined to give figures but intimated that the cost per cushion is, at present, substantially higher. When overall cost items, such as space saving in body, weight saving, saving in handling, and advertising possibilities, are included, costs compare favorably, the author argued.

It was also brought out in reply to a query that there is sufficient source of raw material used in foamed latex to supply the entire automotive field as well as the requirement of other industries. Mass-production methods have not yet been merited by demands for specific items, Mr. Ellies stated.

If a foamed-latex pad is substituted for the conventional cotton and sisal pad, different springing is required, was the author's answer to another question.

Asked about odor, Mr. Ellies explained that the amount of moisture used in curing dictates the amount of odor, as odor-bearing materials are water-soluble. The product can be processed so that the odor is not detectable, he added.

Many foamed-latex products were on display in an adjoining room.

At the conclusion of the discussion Mr. Spring introduced Mr. Gould, the second speaker on the program.

Trends in Mobile Air Conditioning – **R. E. GOULD, Frigidaire Division, General Motors Sales Corp.**

REVIEWING what has been done in mobile air conditioning, and calling attention to the present status of equipment which is being applied, the author remarks that the progress in mobile air conditioning has been based largely on development in stationary equipment.

Mr. Gould briefly describes the more common air-conditioning systems which have been applied to the 11,000 railroad cars now air conditioned.

About one-third of the cars, he reports, use an ice system; about 12% a steam jet system; and the remaining 50% employ some form of vapor compression system involving the use of a mechanical compressor. He also notes that motor bus applications to date employ this system.

He predicts that, by this coming summer, there will be between 300 and 400 air-conditioned motor buses on the highway.

Discussion

F. M. Young, Young Radiator Co., was the first to answer Mr. Spring's call for discussion. He feels that those doing work on motor-vehicle air conditioning should depart from methods used by the railroads; that they should open new avenues of approach by engineering of bodies for air conditioning and developing correct power sources.

In answer to a question by Mr. Spring, the author estimated that equipment to air-condition properly a passenger car would weigh from 150 to 200 lb, and that this weight could be reduced somewhat by insulation and better body design.

Replying to a question by Joseph Geschelin, *Automotive Industries,* as to the probability of passenger-car air conditioning in the future, Mr. Gould said it is largely a question of power. Passenger heat, heat from sunlight due to large glass areas, and infiltration of air, are other problems noted by the author.

The question as to utilizing the waste heat of a motor-vehicle engine by using some type of ammonia absorption apparatus was answered by the statement that it is not practical because of weight and the necessity of maintaining liquid levels which is difficult on moving vehicles. So far as the author knows an exhaust-gas turbine has not been used as a source of power for air-conditioning equipment.

L. P. Saunders, Harrison Division of GMC, advocates that the SAE and the American Society of Heating & Ventilating Engineers should form a joint committee to study the problem of air conditioning of motor vehicles.

Aircraft Sessions

Chairmen

T. P. Wright **F. W. Caldwell**

High-lift devices and flaps were analyzed in great variety at the first Aircraft Session, in an effort to provide safer planes and lower landing speeds. At the second session attention was focused on the material and speed aspects of the propeller problem in turn, with fruitful results.

A Summary of NACA Investigations of High-Lift Devices – **CARL J. WENZINGER, National Advisory Committee for Aeronautics.**

HIGH-LIFT devices for improving safety in flight recently have assumed increasing importance because of the higher and higher performances demanded of both commercial and military airplanes, increases in size and weight, and rises in wing loadings, Mr. Wenzinger points out. In addition, he draws attention to the necessity for keeping landing speeds down to a reasonable figure, and for devising arrangements for assisting the take-off of large and heavily loaded airplanes because of the limitations of length of present-day runways.

Summarizing the extensive investigations of lift-increasing devices carried out by the National Advisory Committee for Aeronautics during the past 10 years, the author stresses their effect on lift. Two general classes are considered: those located at the leading edge of the wing, and those located near the trailing edge. Several combinations of both are included.

Among the devices investigated are slots and flaps of numerous types and sizes, wings of low aspect ratio, suction or pressure for controlling the boundary layer, and rotating cylinders. The effects on lift due to the type of high-lift device, to the size, location, wing section, and the Reynolds Number are discussed, and general trends are indicated in the form of charts.

The author concludes that the slotted types of flap appear to be the most promising on the basis of the aerodynamic characteristics listed, in particular the NACA arrangement of the double-slotted flap.

Discussion

Improvements possible in private flying through the application of high-lift devices to private planes were noted by J. H. Geisse, Bureau of Air Commerce. They should help to develop an economical, slow private plane, he pointed out, that could take off and land in much less space, and should aid in reducing the cost per hour which, he explained, is more important in private flying than cost per mile.

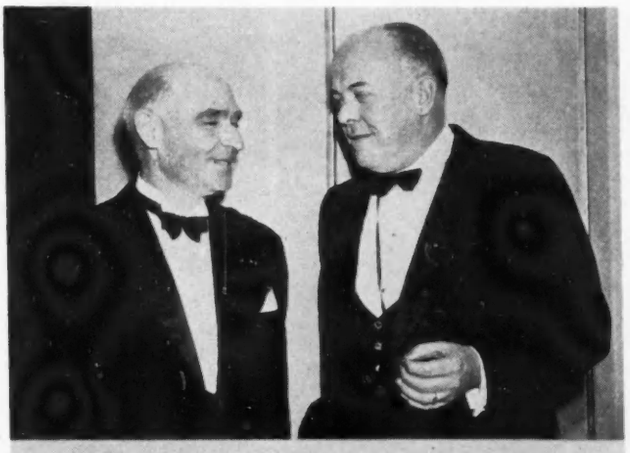
Fred E. Weick, Engineering & Research Corp., emphasized the point that the increase in lift of most of the devices discussed is relatively constant throughout the range of Reynolds Numbers. Thus, he explained, an engineer can select his basic airfoil, then add the desired high-lift device, with fair accuracy.

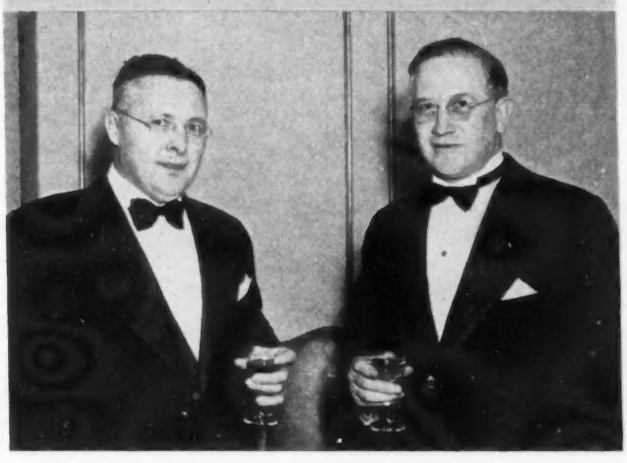
Initial camber of the airfoil is a factor that can be practically ignored in applying high-lift devices, said Mr. Wenzinger in reply to a question by Ralph H. Upson, consulting engineer.

The reason that results on forward slots did not appear in his summary, Mr. Wenzinger explained to Chairman Wright, is that no tests on forward slots at the same Reynolds Numbers were made.

Apparently the NACA slotted flap is the most promising of the high-lift devices, contributed F. R. Weymouth, Curtiss-Wright Corp., in prepared discussion read by Chairman Wright. A line of attack suggests itself as having possibilities, he continued. It would combine the slotted (or perhaps the split) flap with boundary-layer control by suction at the critical points of unstable air flow and blowing out the air at points where it would help to reduce the drag. The ejection points might be at the trailing edge or between the split flap and the wing proper, or perhaps directly into the slot, he suggested.

Dinner Guests Foregather





(Top) Maurice Goudard, past-president, Societe des Ingenieurs de l'Automobile; B. E. Hutchinson, vice-president, Chrysler Corp.

(Center) R. N. Janeway, chairman, SAE Detroit Section; SAE Past-President C. W. Spicer

(Bottom) Nicholas Dreystadt, general manager, Cadillac Motor Car Division, General Motors Corp.; R. K. Evans, vice-president, General Motors Corp.

The Characteristics of a Deflector-Plate Flap – **R. C. MOLLOY and R. W. GRISWOLD, II, United Aircraft Corp.**

RECENT wind-tunnel tests on model airplane wings with slotted flaps having a variety of slot shapes indicate that, if the slot were formed and directed properly, considerable improvement in maximum lift coefficient could be obtained over that of a comparable wing with an ordinary passage between flap and wing, the authors report. Although a lip over the top of the slot was found to be favorable, it did not keep the flap from stalling at high flap deflections, and it was realized that the slot and lip had to have definite characteristics and functions in order to be really effective at all flap angles, they continue. First, they specify, the slot should direct the air from beneath the wing to reenergize the air flowing over the upper surface of the flap and, second, the discharge from the slot should be directed over the flap at all its operative positions.

The authors show how the use of a deflector plate in conjunction with a slotted flap has brought about improved flow over the flap, and has thus enabled the attainment of high maximum-lift coefficients. The provision of a cooperatively working under-surface door keeps the drag low and still allows the use of the best slot shape for maximum lift. A deflector plate also may be attached to flaps of the extended-area type to control the flow over the flap.

Discussion

Discussers of Mr. Molloy's and Mr. Griswold's paper immediately voiced their desires for further comparisons of the slotted deflector plate with other types. The NACA soon will publish comparative test data on the slotted deflector plate and the new NACA slotted flap, Mr. Molloy told one inquirer.

It is important to seal the opening for the high-speed condition in both the deflector plate and NACA slotted flap, added Mr. Wenzinger. It is better to seal the entrance on the lower surface of the wing, he specified.

No tests were made comparing the deflector plate with the plain slotted flap, Mr. Molloy explained to R. R. Childs of Curtiss Aero, because we accepted the results of tests made at Sikorsky Aircraft on plain slotted flaps that showed they were not so good. Mr. Weick and Mr. Molloy expressed their agreement that the slotted-deflector aileron is not desirable.

We have been hearing papers on external airfoil flaps for years, all of which tell of their merits, but we don't find them in service, contended J. H. Geisse, Bureau of Air Commerce. "Why haven't they been taken up by the manufacturers?" he asked.

In answer Mr. Wright suggested that such flaps often increase drag and bring in complication. Mr. Wenzinger added that, in his opinion, the drag penalty should not be large enough to be serious, but that patent situations and the fear of ice formation may have impeded their adoption.

After a short business meeting of the Aircraft Activity, at which members of the nominating committee were elected, the chairman of the Second Aircraft Session, Vice-President F. W. Caldwell, introduced the first speaker, Mr. Weick.

Composite Wood and Plastic Propeller Blades – **F. E. WEICK, Engineering and Research Corp.**

MR. WEICK describes light-weight propeller blades constructed of wood and plastic by the Schwarz process, together with the materials and methods of construction. The blade, he explains, consists of a main core of laminated light wood which merges into a root of impregnated and compressed hard wood which in turn is threaded and screwed into a steel sleeve. The steel sleeve, he notes, can be mounted in either an adjustable or a controllable-pitch hub. The rest of the blade is described as being entirely covered with a heavy coating of reinforced plastic sheet, and the leading edge as protected with a flush strip of metal.

The author analyzes the problem of efficiency, particularly with regard to the effect of blade thickness and the drag of the root sections. He also deals with the matters of service record, flutter and vibration, ease of repair, and ice formation.

Discussion

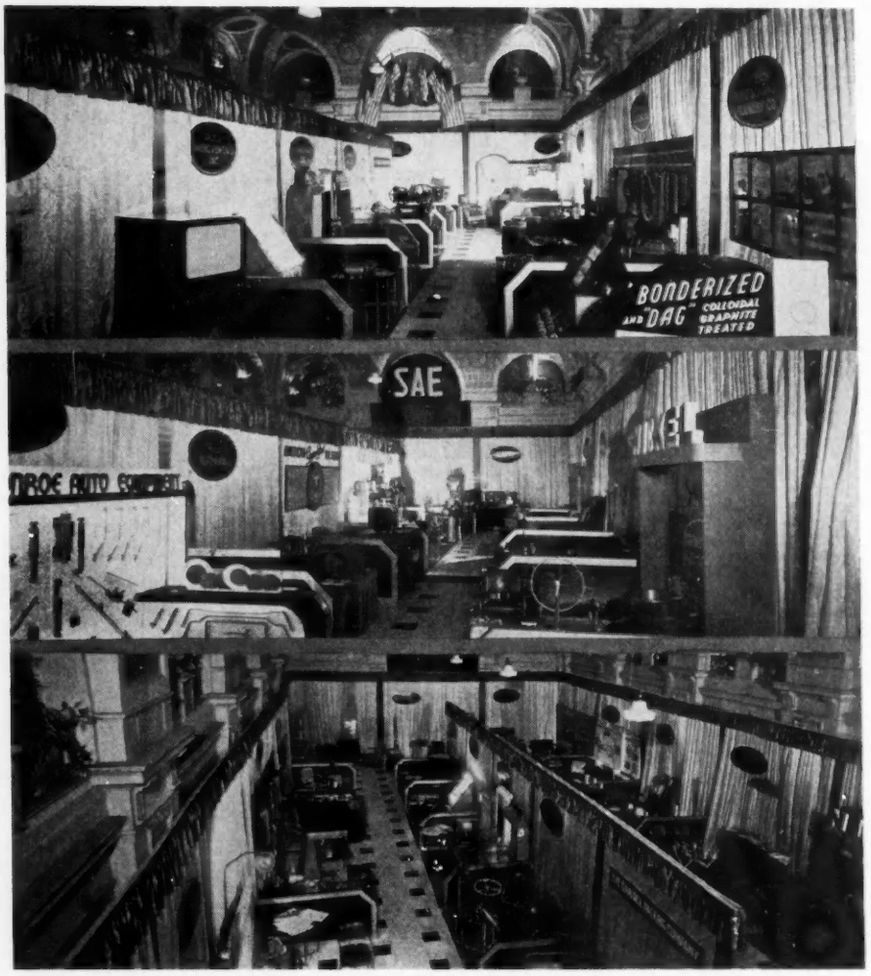
Asking the endurance limit of "compreg," the impregnated and compressed wood used in the root portion of the propeller described by the author, G. T. Lampton, Aviation Mfg. Corp., was the first discusser. Mr. Weick indicated that it is satisfactory but that there are no good data yet available. Mr. Caldwell added that it is reasonable to expect 60% of ultimate.

Roland Chilton, Wright Aeronautical Corp., praised the general idea of bringing the propeller airfoil nearer to the hub to improve cooling, as noted by Mr. Weick.

On the subject of using metal to reinforce a plastic, R. W.

New Products and Ideas at 1939 Engineering Exhibit

ACTIVITY and interest in the important engineering displays this year was greater than ever before. Increased attendance at the meeting itself combined with unusually dramatic product exhibits to bring a new high in number of man-hours spent in the booths by automotive engineers and executives from every branch of the industry.



THE exhibitors were: Acheson Colloids Corp.; Air Reduction Sales Co.; Aluminum Co. of America; Aluminum Industries, Inc.; American Bosch Corp.; American Felt Co.; Campbell, Wyant & Cannon Foundry Co.; Cities Service Oil Co.; Cleveland Graphite Bronze Co.; DeLuxe Products Corp.; Diesel Equipment Corp.; Doehler Die Casting Co.; Fleming Mfg. Co.; Garlock Packing Co.; Gear Processing, Inc.; Gemmer Mfg. Co.; Hercules Motors Corp.; Hoof Products Co.; K. L. Herrmann; International Nickel Co., Inc.; Koppers Co.-American Hammered Piston Ring Division; Monroe Auto Equipment Co.; Monsanto Chemical Co.; Motor Improvements, Inc.; Rohm & Haas Co.; Spicer Mfg. Corp.; Stewart-Warner Corp.; Victor Mfg. & Gasket Co.; Waukesha Motor Co.; Zollner Machine Works.

Lytle remarked that the main difficulty in making a bond is the difference in thermal expansion and that his company (Formica Insulation Corp.) does this with a mechanical bond and not by adhesion.

Asked by T. P. Wright, Curtiss-Wright Corp., if thinner sections could not be obtained by compressing wood all the way out to the tip of the propeller, Mr. Weick answered that it could be done, but he doubted the necessity of doing it.

Mr. Weick, in answering a question by Peter Altman, University of Detroit, as to whether the protecting coat of cellulose-acetate plastic tended to separate from the wood of the propeller due to temperature changes, replied in the negative. The solvents in the plastic, he said, are removed by curing before the propeller is finished. If this were not done, he added, the plastic would tend to shrink.

At the conclusion of the discussion of Mr. Weick's paper, Mr. Caldwell introduced the second speaker, Mr. Rhines.

The Choice of Operating Speeds for Propellers of Limited Diameter – **T. B. RHINES, United Aircraft Corp.**

WITH a variety of gear ratios available for various airplane propeller speeds, which should be chosen for a particular installation? And, after the gear is chosen, how should the engine speed be controlled for those conditions where a range of engine speeds is available? The answers to these questions are offered in his paper for cases where the propeller diameter is limited to some maximum value, Mr. Rhines announces. However, he qualifies, complete general answers to these problems are not available because of the number of possible variables.

From propeller test data and propeller performance estimates, the author explains, charts are developed to show the propeller speeds which should be used to obtain best efficiency in cases where the propeller diameter is limited by clearance conditions or otherwise. Allowance for the effects of the propeller-blade shape on the best operating speed is included. The charts are designed to provide the best possible compromise between efficiency losses due to excessive tip speeds and losses due to excessive angle of attack of the blades. The results are applicable also to the choice of propeller diameters in cases where a small propeller is desired, even though there may be no strict limitations as to its size, the author states.

Discussion

In discussion of Mr. Rhines' paper, Mr. Wright mentioned that, due to increasing speeds, it will probably be necessary to have two selective propeller gear ratios: one for take-off and the other for cruising.

Mr. Lampton noted that loss of static thrust, while it increases the time of take-off, does not greatly increase the length of the take-off run, and asked if it would not be better to add a few yards to the run than throw in an added set of gears.

Mr. Caldwell stated that relative thrust is actually bad up to 90 mph for conditions mentioned by Mr. Wright, so that the necessity of a two-speed gear will be present.

Mr. Wright asked if the tip-speed losses are now more severe than believed at the time of Mr. Weick's book on the subject. In reply Mr. Weick stated that those shown in the book are still valid. Mr. Lampton then mentioned the fact that further information on tip-speed losses is being obtained at Wright Field in connection with whirling tests. On this subject Mr.

Rhines warned that whirling tests must be used with caution because of absence of forward velocity which materially increases the rate at which losses increase after critical tip speed is exceeded.

Aircraft-Engine Sessions

Chairmen

H. K. Cummings **Robert Insley**

Arthur Nutt

Many developments long awaited by operators and engine builders alike were revealed in the three Aircraft-Engine Sessions. At the first, data were presented to make it appear that a non-icing fully maneuverable carburetor had arrived at last, and a new method of cruising control was explained that promises even greater cruising economy.

A resilient engine mounting that virtually confines engine vibration to the engine itself was demonstrated by a working model, and a review of aircraft-engine valve mechanisms revived the long-standing sleeve-valve versus poppet-valve controversy, at the second session.

An interpretive tribute to Charles M. Manly for his achievements in the development of the forerunner of the modern aircraft engine, and in other phases of aircraft and automotive engineering, was delivered at the final session.

BMEP Parameter for Cruising Power Control – R. E. JOHNSON and W. G. LUNDQUIST, Wright Aeronautical Corp.

VIBRATION characteristics and considerations of simplicity, rather than those of operating efficiency, have dictated present methods of aircraft operation, the authors contend. The bmep parameter proposed in their paper, they explain, is based upon cruising operation at or near maximum efficiency of the engine-airplane-propeller combination. They stress the importance of cruising-flight control by pointing out that cruising flight embodies 95 to 99% of all commercial flying.

The authors show how the parameter is related fundamentally to the operating efficiency of the engine as defined by fuel consumption and, therefore, to the overall efficiency of the airplane-engine-propeller combination. The parameter is discussed further as related to the engine alone; as tempered by considerations of airplane and propeller efficiency; as applied to the physical problem of controlling cruising power; and as limited by engine and airplane design.

More complete basic information upon engine and airplane performance than was previously available will be required, the authors indicate, and use of the parameter will involve some complication of cruising-power control over some simple methods in use. However, they conclude, the parameter method points the way to substantial improvement in operating efficiency.

Discussion

Pan-American Pacific is an air line for which we worked out the bmep parameter discussed in our paper, Mr. Johnson revealed, in answer to a question by F. C. Mock, Bendix Products Corp.

"It looks as though it will be possible to cruise down to about 1000 rpm using the system if the carburetor can stand it," Mr. Johnson told M. J. Kittler of Holley Carburetor Co. However, he added, we must not forget the change in fundamental requirements of accessories that results from operating at 1000 rpm. Discussion was followed by a short business session of the Aircraft-Engine Activity in which a nominating committee was elected.

A Non-Icing, Fully Maneuverable Aircraft Carburetor – M. J. KITTLER, Holley Carburetor Co.

NEITHER severe military maneuvers, such as power dives and inverted flight, nor icing conditions will affect appreciably the operation of the aircraft carburetor described in his paper, Mr. Kittler asserts. To back his claim, he points to over 1½ years experience with several hundred of these carburetors since the start of their development in 1935.

After a discussion of the problems of icing, maneuverability, and metering, the author details the construction and operation of the type of carburetor finally developed. This carburetor is unlike commonly known types, he explains, in that the fuel level is controlled by a double-diaphragm mechanism instead of by the conventional float mechanism. In place of the fixed venturi and butterfly throttle construction is a variable-venturi mechanism which forms both the throttles and the venturi. Metering is governed, Mr. Kittler continues, by a tapered needle valve actuated by a cam linked to the venturi throttles so that both the air and fuel passage of the carburetor expand simultaneously as the venturi throttles are opened.

Discussion

Describing the carburetor discussed by Mr. Kittler as a "daring departure from the practice of the last 20 years," F. C. Mock, Bendix Products Corp., in written discussion, commented on a number of features of the device. "Ice formation at the throttle orifice," he pointed out, "has been avoided by locating the jet on the engine side so that evaporation occurs down in the hot parts of the engine where ice cannot form. When the jet flow is induced by the suction beyond the throttle orifice, however, as in this particular design, we encounter an anomalous condition that a very high suction or depression is placed on the jet at idle when we need the least fuel, and the suction is least at wide-open throttle when we need the most fuel." This condition, he continued, requires the substitution of a cam-and-needle control orifice in place of the old simple metering jet which, along with a tendency toward boiling in the jet, is the "price paid by this design for elimination of intake-air preheat." Mr. Mock also supplemented Mr. Kittler's explanation of mixture variation under speed and altitude changes. Right now, he concluded, we must make the aircraft carburetor as automatic as we can; yet we must make provision to permit the operator to play with it too.

In reply Mr. Kittler expressed agreement with most of the points made by Mr. Mock. We have found that the metering jets require just as close accuracy as does the orifice and needle, he reported, with limits of ± 0.003 in. Referring to the float vent, through which bubbles escaped in the older float-type carburetors according to Mr. Mock, Mr. Kittler contended that this vent is open only at sea level – it no longer functions as originally intended at altitude.

J. H. Geisse, Bureau of Air Commerce, stated that he sees no reason to compromise between altitude compensation and load compensation, expressing his opinion that they are practically the same thing. "Won't the accelerator well 'dunk' fuel when the engine is cut off?" he asked Mr. Kittler. He also commented that he had received several reports of icing of this "non-icing" carburetor.

As far as we know, none of these carburetors has iced, Mr. Kittler reported. In a few cases the pilot thought he had icing, but we could never check it as such, he continued; these engines may have got rough, but they always kept going. Without a device that I neglected to tell you about, he said in reply to another of Mr. Geisse's questions, the pump would "dunk" fuel. He then explained how the device prevents this trouble. Referring to the load and altitude compensation, he agreed generally with Mr. Geisse that there is a certain degree of similarity between the two results.

Dynamic Suspension, a Method of Aircraft-Engine Mounting – K. A. BROWNE, Wright Aeronautical Corp.

DYNAMIC suspension in aircraft-engine mountings, Mr. Browne explains, has been organized to provide elastic freedom linearly corresponding to the vertical and horizontal freedom of the shafts of the horse rig, angular freedom corresponding to the swingletree action, and torsional freedom as provided by the traces; yet it has the restraint necessary to hold the powerplant in place and to allow it to pull the aircraft. Like "floating power," he states, the system is based on the principle of vibration isolation which employs elastic engine mounts that allow the unbalanced forces acting on the powerplant to create their own counterbalances by acceleration of its total mass, thus leaving the supporting structure virtually undisturbed.

The distinguishing feature of dynamic suspension is named as the

accomplishment of a true center-of-gravity support by means of directional spring attachments on the rear of the engine. The data presented include descriptions of several experimental applications; a chart of spring characteristics for the most useful design; corrections to the basic frequencies for aircraft operation; ground and flight tests on the test stand and the dynamometer; and a comparison of an example engine-mount analysis with actual experimental results.

Discussion

Demonstration of the dynamic suspension and other types of engine mount by Mr. Browne, following his reading, proved very popular with an attendance that left "standing room only." Using a small working model of engine, propeller, and wing, he showed how the dynamic suspension isolates and reduces the vibration as compared with the old stiff engine mount, the same mount with rubber bushings, and the Army type of mount. He also demonstrated the relative effects of various causes of unbalance, such as missing cylinders or loss of a propeller tip.

"How do you take care of excessive movement of the power-plant in relation to plumbing and other service connections?" asked Walter C. Keys, U. S. Rubber Products, Inc. He also wanted to know about the bond stresses in the rubber.

Excessive movement is not a problem, Mr. Browne explained, as it occurs only when a cylinder is missing or at the low resonant speed; the rest of the time the engine hardly moves. Maximum shear stress in the rubber is 50 lb per sq in., he reported, and, in compression, the aim is to hold the stress to 500 lb per sq in. of projected area.

Aircraft-Engine Valve Mechanisms – **V. C. YOUNG, Wilcox-Rich Division, Eaton Mfg. Co.**

NEMESIS of aircraft valve mechanism is false motion, Mr. Young believes. False motion in valve gear, he explains, is any motion of parts other than the theoretical, and it affects any part of the mechanism from the valve to the cam, since high loadings can be encountered which far exceed the calculated stresses. The result often is failure, either partial or complete. He illustrates this point by diagrams of actual valve motion under operating conditions. Emphasis is placed on other effects from the same cause, such as high seating velocities.

In a discussion of the hydraulic lash adjuster, the author stresses its effect on seating velocities and maintenance of fixed timing, referring particularly to air-cooled radial engines.

The importance of reduced operating temperatures of the valves is pointed out in regard to increased strength, and to improved fatigue and corrosion resistance.

Discussion

Mr. Young's paper gives evidence of the splendid work that has been done lately in the development of the American poppet valve, Chairman Insley commented, to lead off the discussion. Modern poppet valves, he said, will run 500 to 600 hr between overhauls without attention, and have a life of 5000 to 6000 hr. Sleeve valves must better these marks to be considered, he opined.

With speeds going up and with mep's up to 225 lb per sq in., it is no time for poppet-valve engineers to be resting on their laurels, warned Arthur Nutt of Wright Aeronautical Corp. It looks as though there may be a swing to sleeve valves, he predicted, but it probably will be only for certain types.

No material exists that can meet all the requirements for a valve steel set down by Dr. Aitchison and others, and listed in Mr. Young's paper, contended A. T. Colwell, Thompson Products, Inc. The best steel that we now have cannot meet the strength requirement at 1600 F, he explained. With reference to the breakage problem, we want to test different designs of valve necks and materials to improve the situation, he reported. He agreed with Mr. Young that the seating velocity of a valve is tremendously important, and that much trouble is due to the fact that valves don't seat the way they are designed to seat. "The sleeve valve engine," he reported, "is something like the man with the bald head – he has less hair to comb but a lot more face to wash."

"It is about time that we forgot about specifications for valve steels and judged materials by their performance in engines," contended S. D. Heron, Ethyl Gasoline Corp., taking issue with Mr. Young in accepting Dr. Aitchison's requirements.

My purpose in quoting these requirements was to bring out the emphasis on temperatures, Mr. Young explained, but now "I am sorry that I brought them up."

Manly, the Engineer – **C. B. VEAL, Society of Automotive Engineers.**

IN 1900, old experienced engine builders were saying "impossible" to an 18 to 22 lb per hp ratio for an engine which was being designed for use in the man-carrying flying machine under development by Dr. S. P. Langley, Secretary of the Smithsonian Institution. By December, 1901, working as Dr. Langley's chief assistant – and having taken personal responsibility for the engine development – Charles Matthews Manly had completed an engine which weighed, net 125 lb, developed 52.4 hp at 950 rpm and had demonstrated its durability in three separate 10-hr full-power endurance runs. This 2.4 lb per hp ratio was not surpassed until the advent of the Liberty engine 16 years later.

Dramatic details of this most frequently recorded achievement of the distinguished engineer who was SAE president in 1919 are recorded in this paper as part of an interpretive study of Mr. Manly's broad achievements. Mr. Manly's important development work on other phases of the Langley airplane, his pioneering designs in the field of hydraulic power transmission, his vital contributions to military aviation throughout the World War period and his broad service to society through SAE activities are summarized and illustrated.

The theme of Mr. Manly's life, the author says, was engineering. "His criterion of an objective was: 'Will it serve'; of a method, 'Will it work.' The past informed, but did not form him. Novelty, in itself, he neither feared nor favored. His application of engineering principles was courageous and clear-sighted; it led him to many conclusions which, new in his time, have been approved by the irrefutable logic of experience."

Transportation and Maintenance Sessions

Chairmen

F. L. Faulkner **H. O. Mathews**

A session devoted to the compulsory inspection of motor vehicles in state-controlled safety lanes, and another, at which the merits and faults of oil filters were clearly analyzed and debated, were the Transportation and Maintenance Activity's well received contributions to the program.

That T&M men are safety-minded was evidenced by the full attention given to the papers presented by Mr. Winchester and Mr. Williams at the opening session.

Safety Lane Testing – **J. F. WINCHESTER and J. J. POWELSON, Standard Oil Co. of New Jersey.**

IF compulsory safety-lane testing is conducted honestly, thoroughly and efficiently and is effective in reducing the number and lessening the severity of accidents the fleet operator, in common with all users of motor vehicles, will share in the many resultant benefits and savings, the authors believe. Some of these benefits are:

1. Lower accident repair cost.
2. Ultimate lower insurance cost.
3. Less lost-vehicle time.
4. Better service to customer or trade.
5. Greater earning power per vehicle. Driver's wages constitute about 50% of the total vehicle operating cost, and unproductive driver's time when accidents occur represents serious loss.
6. Greater tire mileage due to better average wheel alignment.
7. Lower depreciation because of longer average vehicle life.
8. Eventual tax reduction due to lower public hospitalization cost and possible lower police cost.

The fleet operator will undoubtedly be put to some additional expense per vehicle, varying between rather narrow limits, depending upon the character of the fleet, operating conditions, and so on, and his administrative personnel will have additional work in handling the necessary routine. To offset these two disadvantages we have the following:

There is a definite possibility of making effective use of the expensive

state testing equipment and trained personnel to check the quality and thoroughness of current maintenance work and to study possible changes in maintenance routine, at least with regards to brakes, wheel alignment, and lights. Arrangements can usually be made for inspections in the state stations more often than required by law.

Compulsory Vehicle Inspection from the Safety Viewpoint – **SIDNEY J. WILLIAMS, Public Safety Division, National Safety Council.**

THAT compulsory vehicle inspection programs of the type discussed in his paper are worth while as part of a general safety program if competently administered, is the consensus of traffic and safety men, Mr. Williams contends.

Three benefits are listed for this type of inspection:

1. It improves the general standard of vehicle condition.
2. It improves the quality of garage workmanship.
3. It provides an excellent opportunity for informing drivers about the condition of their cars and their personal responsibility for driving safely when their vehicles have been approved.

This inspection is compulsory for all motor vehicles in a city or state, the author explains; is periodic, generally twice a year; uses stationary equipment at stations operated by the city or state; costs not over $0.50 per inspection, which is paid for either by a fee or from general motor-vehicle funds. This type of inspection program is now found in 4 states and at least 12 cities outside these states, he reports.

Discussion

Debate as to the methods by which compulsory inspection of motor vehicles, particularly those in fleets, should be carried on, rather than as to the merit of compulsory motor-vehicle inspection, which was generally agreed upon, was one of the features of the discussion.

Favoring state or city-operated testing stations over other systems now being utilized, Session Chairman Faulkner stated that he leans to more rigid standards of inspection than hitherto have been set up. He feels that duplication of effort is compensated for by improvement in work of mechanics, supervisors, and others in fleet shops and service garages who realize that their work is being checked at the safety lanes. S. G. Tilden, S. G. Tilden, Inc., remarked that it is "just as logical and necessary that we have compulsory vehicle inspection and compulsory financial responsibility as it is that we have compulsory enforcement of traffic regulations."

J. Verne Savage, who has charge of vehicle inspection for the City of Portland, Ore., pointed out the economic benefit to the car owner who has his car tested as a check-up on his service man. He told of instances where new cars were found out of alignment; correction of which saved undue tire wear and possibly more serious trouble. Along this line Austin Wolf, automotive consultant, pointed out that not all car dealers are equipped to put new cars in shape before delivery and that the owners benefit by having the dealers' work checked at safety lanes.

Inspection in the fleet's own shops under supervision of state inspectors was favored by Capt. O. A. Axelson, Columbia Gas & Electric Corp., who argued that, under this system, inspections can be made at less cost and without tie-ups while waiting at public stations. If we are to have compulsory inspections at state or municipal stations, he added, we must be sure that it doesn't get out of hand and that the number of inspections per year does not advance from one or two, to six or even twelve per year.

David Beecroft, Bendix Products Corp., reviewed the part which the SAE is taking in connection with the work of the Sectional Committee (D-7) on Motor Vehicle Inspection operating under American Standards Association procedure. The Society, he said, is undertaking the research work to get definite data upon which the brake sub-committee can base a code. B. B. Bachman, Autocar Co., entered the discussion to stress further the necessity of thorough research by the SAE before recommendations as to brake tests are made.

Mr. Beecroft also voiced his opinion that, in inspecting brakes of commercial vehicles, tests should be made with the vehicles at full load, and that inspection stations should have scales as part of their equipment. In answer to this opinion Mr. Savage stated that he believes scales will be used in the future. At the present time, however, tolerances are so wide that scales are not necessary, he pointed out.

Merrill C. Horine, Mack Mfg. Corp., while favoring state inspection, pointed out that it is but one phase of accident prevention. We must be careful, he warned, that under political control it does not get too much emphasis.

T. L. Preble, Tide Water Associated Oil Co., commented that data as to the frequency of rejects, classified as to causes, should be made available by inspection stations so that they might be utilized by designing engineers.

James E. Hale, Firestone Tire & Rubber Co., told of the tire industry's willingness to cooperate in contributing to the development of sound motor-vehicle inspection codes. This was in reply to a statement by Mr. Williams to the effect that tire-company engineers have not been able to supply data as to just when tires become unsafe.

In summing up, Mr. Winchester said that he recognizes the danger in political control of motor-vehicle inspection, but that something must be done to overcome loose inspection methods.

Mr. Williams, who is chairman of the D-7 Committee, agreed that much careful study is needed in establishing a code, but does not believe that it should be carried to an extreme. "Man doesn't wait for absolute perfection in anything," he declared.

While it is impossible to evaluate the effect of each contribution to safety, he stated in closing, "We must put everything we can into safety work; we must work toward continued reduction in fatalities and accidents."

The opening moments of the second T&M Session were devoted to a business meeting of the Activity, at which members of the 1939 nominating committee were chosen. At the close of the business meeting Chairman H. O. Mathews introduced the speaker, Mr. Wolf.

Filtering Fallacies – **AUSTIN M. WOLF, Automotive Consultant, New York City.**

THE introduction of the oil filter into the lubricating system of internal-combustion engines marked a distinct advancement, Mr. Wolf states. However, he adds, due to the varying combination of working conditions, the operator who dreams that all lubrication problems are eliminated by the use of oil filters is due for a rude awakening. He continues, to remark that any valuable tool can be abused if full cognizance is not taken of its possible shortcomings, and he enumerates those of the filter to form a basis of a true appraisal of its intrinsic worth.

Mr. Wolf notes that conflicting opinions are heard regarding filters due to the widely different circumstances under which identical equipment is operated. In stop-and-start operations, light delivery trucks and some passenger cars never have the engine warm enough in extremely cold weather to permit functioning of the filter, he points out. He also states that, at the other extreme, oil oxidation through high engine temperatures can produce materials that will clog it. Improper installations, type of filtering media, filter capacities, frequency of cleaning or replacing elements, neglect of servicing, moisture accumulation, oil acidity determinations, miscibility of undesirables in the lubricating oil, mechanical versus chemical filters, and the removal of additives, are some of the topics discussed by the author, with conclusions based upon field and laboratory studies.

Discussion

Time alone limited the discussion of Mr. Wolf's paper which was so comprehensive that it stimulated fleet operators, filter men, truck manufacturers, and representatives of the petroleum industry to contribute their comments.

The first discusser was Capt. O. A. Axelson who revealed that during the past three years his company (Columbia Gas & Electric Corp.) has spent more than $20,000 for filters and cartridges. "To this day," he added, "I don't know whether it was a profitable investment or not." He had hoped that Mr. Wolf would give him the answer, he added.

He went on to note increase in mileage per gallon of oil, in life of vehicles, and in periods between ring changes since

1935 when filters were installed, calling attention, however, that during that period engines have been made better, gasoline has been improved, lubricating oil has made tremendous strides, and the preventive maintenance schedule of the fleet has been much more comprehensive. Also, he noted, one operation which did not install filters showed less expenditure per car for maintenance than the others during the past year. He summed up his discussion with the statement: "And I still want to know if the $20,000 we have spent for oil filters was a good investment."

This discussion by Capt. Axelson reflected the question in the minds of other operators who participated in the discussion. George L. Neely gave them some hope by announcing that his company (Standard Oil Co. of Calif.) is starting a comprehensive program to get adequate data on filters.

F. L. Faulkner, Armour & Co., stated that the fleet under his charge uses filters only when they are installed by the vehicle manufacturer when they go into service, and then only in controlled operations. In such service, he stated, they have been an economical investment.

Agreeing with Mr. Wolf, James E. Hurn, DeLuxe Products Corp., said that a correctly designed engine and its lubricating system should include a filter. He also stated that if sufficient volume of oil cannot be delivered to the filter to allow the filter to serve its purpose without dropping the pressure in the lubricating system, the pump capacity of the motor must be increased.

W. C. Bauer, Briggs Clarifier Co., averred that use of a filter with a Fullers earth element will maintain a low neutralization number in the crankcase.

Commenting on the presence of nitrogen compounds in the oil, A. W. Burwell stated that his company (Alox Corp.) in connection with its work on oiliness has examined all classes of nitrogen compounds soluble in hydrocarbon oils, even in minute quantities. In no case, he stated, has any such addition failed to cause film rupture with subsequent roughening of bearing metal surface, or at least fatigue of composite bearing metals such as copper-lead.

In his discussion Fred Heinlein, Cincinnati Gas & Electric Co., decried the fact that many operators fail to maintain a system of checking the air-fuel ratio and especially carburetor-air cleaners. The maintenance of carburetor-air cleaners, he continued, is of great importance in operation of passenger cars as well as trucks and buses.

"It seems to me," said Merrill C. Horine, Mack Mfg. Corp., when called upon, "that the principal things which an oil filter can do well are those things which cannot conceivably be accomplished in any other way, whereas the mischief which oil filters are alleged to work in some cases is due almost entirely to imperfections in engine design, either in themselves or as a result of the complications introduced by lube oil additives which these imperfections require."

C. M. Larson, Sinclair Refining Co., pointed out that, after years of educating the public that dirty oil on the bayonet indicated an oil change, we must now re-educate them to realize that the appearance of an oil is no criterion. A clean-looking oil, he continued, may soon stick an engine.

H. M. Rugg, Pennsylvania Grade Crude Oil Association, entered the discussion with data contradicting statements that oil changes are unnecessary if a certain filter is used. He feels, however, that properly used and serviced filters play a valuable part in increasing engine life by removing contamination from the oil.

Among other discussers were J. R. North, Commonwealth & Southern Corp., who gave some interesting before-and-after figures, and Prof. H. A. Everett, Pennsylvania State College, who challenged Mr. Wolf's contention that oil does wear out. Written discussions prepared by Clinton Brettell, B. E. Sibley, Continental Oil Co., and H. O. Mathews, Public Utility Engineering & Service Corp., were not read because of time limitation.

Fuels and Lubricants Sessions

Chairmen

B. E. Sibley **D. P. Barnard**

Three important pieces of the many that must be fitted into place to solve the "jigsaw puzzle" that is the detonation problem, were supplied in the two Fuels and Lubricants Sessions, and the hope of soon finding many more in the near future was apparent from the ideas and suggestions expressed in discussion. Three papers stressed the relation of spark timing, power loss, and mixture distribution to detonation. A fourth paper discussed the fundamental reasons for the differences in fuel requirements of gasoline, diesel, and spark-ignition oil engines.

Spark Timing and Its Relation to Road Octane Numbers and Engine Performance – T. B. RENDEL and L. E. HEBL, Shell Petroleum Corp.

THAT the octane or antiknock requirement of a car is a function of the octane number of the fuel supplied to that car, is the paradoxical conclusion reached by the authors from the results of numerous surveys made during the past three or four years. The main reason for this condition, they contend, is the flexibility of present-day spark-advance mechanisms and the setting of these devices built into the car by the manufacturer so that his product may digest the products of the various fuel suppliers.

Measurements in the authors' laboratory have shown that the differences between the power that is obtained with present spark timings and that which could be obtained at maximum power spark timing do not differ greatly among cars, and are of the order of 1 to 2%.

As a future program, the authors recommend investigation of how the shape and slope of the highest useful spark-advance curve is influenced by fuel characteristics, engine design, and by the conditions under which the engine is operated, and of how it can be fitted to the maximum-power spark-advance curve.

Such work, they believe, will go a long way toward solving the riddle of the excessive variability of road octane numbers; it will allow the engine designer to fit his engine to the fuels now available without complicated gadgets which frequently cause trouble because of maladjustment; and it will allow the fuel research chemist to adjust the detonating tendency of his new fuels in the engines which the engine manufacturer is planning for the newer models.

Power Loss Accompanying Detonation – NEIL MacCOULL, The Texas Co.

RESULTS of tests on several motor cars reported in his paper, Mr. MacCoull comments, "make one wonder if it is economically necessary for a car to be completely free from knock at all times." Use of a spark retarded slightly from that required for optimum power, he found, resulted in a trivial power loss, but appreciably lowered the octane requirement.

In additional tests on a single-cylinder CFR engine, where power output and various temperatures were studied, as the compression was raised *above the critical compression ratio,* the author found that:

1. Power output increased steadily with compression ratio if the spark advance was adjusted for maximum power at each ratio. The limit apparently was set by preignition.

2. If the spark was retarded to the threshold of knock at each compression ratio, the power increased and then dropped off rapidly at higher compressions.

3. Temperatures of spark plug, piston, and intake valve rose with compression ratio even when free from detonation, but compression ratios above the critical did not cause excessive temperatures.

4. Temperatures of exhaust gas and exhaust valve, as well as heat losses to jacket, were lowered with increased compression ratio, even during detonation, when the spark was set for maximum power.

Discussion

Charts showing the spread in octane requirements of cars of a given make in a given year were displayed by J. O.

Eisinger, Standard Oil Co. (Ind.), the first to read his prepared discussion. The spreads shown, up to 26 octane numbers, were due primarily to differences in ignition characteristics, Mr. Eisinger believes. Another chart showed the decrease in octane requirements effected by making certain adjustments to the engine, such as changing distributors, changing breaker points, removing carbon, and adjusting the spark setting. He concluded by confirming the author's statement that increased compression ratios may diminish the advantage now enjoyed by cracked fuels over straight-run fuels.

Test results showing the effect of carbon deposits on the octane requirement and time of acceleration were next reported in written discussion by Earl Bartholomew, Ethyl Gasoline Corp. It is known, he stated, that carbon deposits may increase the fuel antiknock requirements of cars by 15 or more octane numbers.

The form of presentation of Messrs. Hebl's and Rendel's paper particularly impressed Mr. MacCoull. He also commended them on discovering a new fundamental method of attack on the detonation problem.

Mr. MacCoull's sentiments on the presentation of the authors' paper was seconded by Arch Foster of *National Petroleum News*. There are very few SAE papers which could not be presented more effectively if condensed about one-half, he said, quoting the sentiments of a well-known editor. It seems that the engineer needs two kinds of language, he remarked: technical terms when things are going well and profanity when they are not. He pointed out that a slight power loss did not seem to make as much difference to the car buyer as does knocking, probably because the buyer can hear the knocking, but has no instruments by which he can measure power loss. In this problem, he continued, "economics will raise its ugly head and interfere with the pristine glory of pure science." As an example, he suggested that it might be better to concentrate on doing some of the things recommended at this session to lower octane requirements of the cars rather than pay for raising the octane number of the fuel, say from 70 to 85.

W. C. Condit, Sun Oil Co., voiced his opinion that the vacuum spark advance does not seem to give enough advance at part throttle to give maximum economy in all cases.

The driver is much more sensitive to power loss in the low-speed range, than to a moderate loss at high speed, contended J. B. Macauley, Jr., Chrysler Corp., as loss of power at low speeds gives an unpleasant "flat" feeling. He also pointed out that human knock tolerance is a psychological factor and varies over a wide range for different individuals.

The physiology of the problem was introduced by C. E. Cummings of Texas Co. Variation in the audible determination of knock intensity is surprisingly large, he contended, and this point should be remembered in interpreting the data.

The manufacturer sets the spark a little on the retard side, explained J. T. Fitzimmons, Delco-Remy Division, General Motors Corp., so that, if anything happens to the timing, the customer will not be in trouble with knock. Referring to the spark advance at part-throttle mentioned by Mr. Condit and other discussers, he reported that it was found that the necessary spark advance at part throttle could not be carried without getting roughness.

Psychology comes into the problem also in the variation in the individual driver's judgment of whether or not the car is "flat," Mr. Rendel remarked in summary. On the day that he "gets out on the wrong side of the bed," he may think so, he explained, but, on other days, he may not. Referring to Mr. Bartholomew's remarks, he conceded that carbon deposits have their effect, but feels that they don't change the general picture. He agreed with Mr. Eisinger that distributors in service vary widely, and that was one reason, he explained, why they advised using the highest useful spark advance.

To illustrate further the human phase of the problem, Mr. MacCoull told of how he got a number of inexperienced men and women to listen to a car that was "knocking its head off." The result was that not one of them knew it was knocking, he reported – they thought they were hearing the usual car noise.

A short business session was held between papers at which a Nominating Committee for the Fuels and Lubricants Activity was elected.

Fuel and Lubricant Requirements for Gasoline, Compression-Ignition, and Spark-Ignition Oil Engines – **J. B. FISHER, Waukesha Motor Co.**

DETONATION is defined by the author as the "diesel cycle interfering with the otto cycle," and he speaks of an internal-combustion engine as a "concentrated problem in thermodynamics surrounded by a few pounds of iron and steel." He discusses the intimate relationship between the engine and the fuels on which it can be run, and points out that there are 1,500,000 possible combinations of hydrocarbons in fuels, to illustrate the complexity of the problem.

The importance of ignition delay in both high-speed diesel engines and gasoline engines is emphasized, and 50-cetane number is mentioned as the low limit for high-speed diesel fuels. It is not necessarily so, Mr. Fisher points out, that, because exhaust temperatures are lower in diesel engines, other temperatures are lower. He gives data to support his belief that compression ratios of 9:1 are as high as is necessary for best efficiency.

In conclusion, he reviews the operating principles of the Hesselman spark-ignition oil engine, and pleads for improvement or elimination of the exhaust valve, which he believes is the limiting factor in engines.

Discussion

To illustrate his point that turbulence speeds up and intensifies combustion in an engine, Mr. Fisher operated a special demonstration unit that confirmed his claim in spectacular fashion.

Suppose we were to build one perfect engine, speculated O. D. Treiber, Hercules Motors Corp.; we first would select the compression ratio that would give maximum overall efficiency which, in my opinion, would be close to 10:1. Efficiencies are not proportional to compression ratios as some may believe, he contended, but to expansion ratios, and temperatures are limited by Mother Nature. But we still have a missing link, he pointed out, one that will eliminate all octanes and cetanes – an artificial means of igniting the fuel, at compression ratios of around 10:1, as it is sprayed into the cylinder.

Igniting the fuel did not seem such a problem to Mr. Fisher who, in his reply, explained the stratified-charge effect that is obtained in his company's engines.

Automotive Multicylinder Engine Detonation and Mixture Distribution – **A. J. BLACKWOOD, C. B. KASS and O. G. LEWIS, Standard Oil Development Co.**

PRESENT-DAY cars are not capitalizing on the continued efforts of the petroleum industry to provide better fuels, the authors believe. The wide differences found in the octane-number requirements of individual cylinders, plus the failure to obtain uniform mixture distribution from cylinder to cylinder without resorting to fuels of aviation-grade volatility have led them to reach this conclusion, they explain.

The probability that significant reduction in the average antiknock requirements of cars might be effected without making any major changes in the engine is indicated by a survey of the technical literature, they point out. The extensive studies of ignition-system characteristics and gasoline-mixture distribution as affecting detonation reported in their paper bring out the following pertinent points:

1. Variations actually occurring in the spark advance from cylinder to cylinder may vary the octane-number requirement of individual cylinders by about 10 points.

2. With perfectly synchronized spark advance to all cylinders, the variation in mixture strength reaching the individual cylinders during full-throttle operation may still cause a variation of about 15 points in octane-number requirements of the individual cylinders.

3. With the particular test engine used, air-fuel mixture distribution

could be improved markedly only by going to excessively high fuel volatility.

4. Care in assembling cars at the factory could bring about an average decrease in octane-number requirement of several points. This decrease, in turn, could be utilized in future designs to permit of higher compression ratio and increased efficiency.

Discussion

The hope that engineers will get distribution-conscious, so that leaner mixtures can be used without increasing the spark-plug gap, was expressed by Hector Rabezzana, AC Spark Plug Division, General Motors Corp., the first to rise in discussion.

One of the most important factors in the problem is the inability of the spark-advance mechanism to follow the correct curve of spark advance, contended T. H. Risk, Pure Oil Co., showing slides to back his statement. He recommended adjusting the mechanism to give correct timing at 25 mph if the distributor is found to be consistent.

Automobile engines are not composed of duplicate cylinders operating under uniform conditions but, in reality, are a number of single-cylinder engines subjected to divergent temperatures and ignition timing, and burning different fuels at unlike mixture ratios, commented Earl Bartholomew, Ethyl Gasoline Corp., in prepared discussion. In our experience, he reported, the ignition timing from cylinder to cylinder has always varied, but never to the degree found by the authors. Our laboratories take exception to the apparently contradictory conclusion of the authors that "each cylinder probably gets its proportional share of the light and heavy ends" of the fuel, he asserted.

The knocking behavior of multicylinder engines has escaped analysis for many years largely because of the scarcity of instruments that will show exactly what goes on in each cylinder separately, contended W. S. Mount, Socony-Vacuum Oil Co. He then explained how the cathode-ray oscillograph can be used to fill this need.

J. T. Fitzimmons, Delco-Remy Division, General Motors Corp., charged that some of the discussers seemed too pessimistic about the accuracy of automobile ignition equipment. In particular, he took issue with Mr. Kass on the accuracy of distributor cams. Any reputable manufacturer, he contended, should be able to hold synchronism to 1½ deg on the distributor. Many other things in the engine, such as gears, can cause these variations, he pointed out. He showed slides of a special unit for testing a number of distributors on a single engine, and of test data showing the increase in variation when on the engine over that obtained on special test apparatus.

Another such device for mounting distributors on a car on the road was described by L. E. Hebl, Shell Petroleum Corp. He also pointed out that the difference in spark advance from cylinder to cylinder changes considerably with changes in speed.

A plea for greater durability of the ignition equipment and other engine accessories was voiced at this point by J. O. Eisinger, Standard Oil Co. (Ind.), in prepared discussion. Any added cost of accessories caused by this improvement will justify itself to the car builder, the oil industry, and the customer, he contended. We have found that distributors change rapidly with use and are one of the principal causes of knocking today, he charged, citing test data to prove his point.

Introducing the economic side of the problem into the discussion, John M. Campbell, General Motors Corp., wondered how far spark-timing refinements should be carried as long as mixture-ratio variation is so great. Referring to the distribution problem, he remarked that apparently we have gone so far in adopting the more volatile fuels that distribution has become imperfect.

The distribution problem as such has not been answered in any of our studies, reported Mr. Kass in closure. As to spark advance, it seems as though we are quibbling over degrees, he concluded.

Diesel-Engine Sessions

Chairmen

F. G. Shoemaker **Carl Behn**

How can piston temperatures in diesel engines best be measured? Lowered? How much have they to do with varnish formation and ring-sticking? These and other questions were taken up at the Symposium on Piston Temperatures that comprised the first session, with almost as many answers as there were contributors and discussers.

Just how a cathode-ray oscillograph can be set up for use in diesel-engine indication and further data on the combustion process in diesels were revealed in two papers at the final session.

Symposium on Piston Temperatures **– E. T. VINCENT, University of Michigan, presented a digest of contributions on piston temperatures by SIDNEY OLDBERG, Chrysler Corp.; C. G. A. ROSEN, Caterpillar Tractor Co.; P. V. KEYSER, JR., Socony-Vacuum Oil Co.; L. A. WENDT and T. B. RENDEL, Shell Petroleum Corp.; H. WRIGHT BAKER, University of Manchester, England; and PURE OIL CO.**

COMPARISON of the various curves of piston temperature submitted in the six papers comprising this symposium, Mr. Vincent reveals, brings out the fact that all engines do not behave alike, the piston temperatures varying in totally different ways in different engines for the same variable. Each chapter of this symposium, he explains, deals with data obtained from engines of different design.

In most of the contributions, he reports, the investigation was undertaken with the problem of sticking rings and gummed oil in mind, and the results obtained were considered on this basis. This situation is not surprising, he comments, since piston temperature is the most obvious factor accounting for the gumming of oil. However, he points out that Prof. Baker's interest in the problem seems to be of a general nature. The author feels that the actual temperature of the oil leaving the bearings may also have some effect in initiating the breakdown, and should not be overlooked.

After discussing the effects of jacket temperature, speed, and injection timing upon piston temperature, Mr. Vincent summarizes the factors affecting reduction in piston temperatures as brought out in the contributing papers: type of piston; number of rings; width of rings; width of top land; clearance of piston in cylinder; and oil-cooling of piston.

Discussion

The papers of this symposium are heterogeneous due to the differences in the construction and appetites of diesel engines, explained C. G. A. Rosen, Caterpillar Tractor Co., the first contributor to speak. We find the temperature of oil on the crankpin bearing important in tractors as the dust problem prohibits crankcase ventilation, and we believe that the crankpin-bearing temperature, as indicated by the temperature of the oil in the bearing, is directly proportional to the temperature of the air inside the crankcase, he reported.

Answering Mr. Vincent's questions concerning the temperature at which ring-sticking occurs, Mr. Rosen explained that the point at which ring-sticking is initiated is dependent upon the oil-film thickness, as well as upon the temperature of the ring belt. As the oil-film thickness goes down, he pointed out, formation of varnishes is accelerated. What must be done, he believes, is to find the acids responsible for lacquer formations in thin oil films.

Mr. Rosen also described a method of measuring piston temperatures by means of plugs, and compared the effect of various piston materials on piston temperatures.

W. S. Mount, Socony-Vacuum Oil Co., described observations of varnish formation and ring-sticking made on a 2-cycle diesel engine by means of a stroboscope. The first thing that

can be seen, he reported, is brown varnish and, as the formation increases, the piston-ring motion around the groove is observed to become slower and slower until the rings stick, at which time the piston temperatures start to rise rapidly.

"Every time we try to pinch down the amount of metal in a piston crown, a headache results," contributed O. D. Treiber, Hercules Motors Corp., stating that he had never seen too much metal in a piston crown. For better cooling, he recommended driving the water against the hot-spots, and indicated that there was much to be learned about rings, both as to number and material.

In conclusion, Mr. Treiber warned against the danger of crankcase explosions when cutting the throttle of a diesel engine equipped with cast-iron pistons. We found, he revealed, that the explosions came from the lubricating oil coming into contact with the piston crown when the lubricant cracks and explodes after a stop. He explained how this danger can be eliminated by using a diaphragm to keep the oil from the piston crown.

Data indicating that piston temperatures drop off as the cetane number of the fuel burned is increased were contributed at this point by G. C. Wilson, University of Wisconsin.

The time-honored method of getting approximate piston temperatures by means of a cluster of fuse plugs of known melting points was added to those already discussed, by Chairman Shoemaker, Detroit Diesel Division, General Motors Corp. The effect of the cooling oil on our piston temperatures has been surprising, he reported.

Why do diesel piston temperatures run higher than those of a corresponding gasoline engine at the same speed and output in spite of what we read in text books? asked A. W. Pope, Jr., Waukesha Motors Co. Does after-burning, scouring of gases on the piston head, or higher radiant energy of the flame explain this condition?

Two clues were offered in answer to this question by Mr. Vincent and J. P. Stewart, Socony-Vacuum Oil Co. Mr. Vincent recommended that the answer might be suggested in Prof. Baker's paper, and Mr. Stewart presented test data from the ring-sticking standpoint.

Engine Indication with the Cathode Ray Oscillograph – **J. G. WILLIAMS, Superior Engine Division, National Supply Co.**

IN addition to combustion and fuel-line pressure studies, Mr. Williams points out that the cathode-ray oscillograph can be used to investigate the vibrations of the various parts of an engine if a suitable pickup unit is used. Plans are under consideration, he announces, to extend its use in engine studies to include pressure-volume diagrams and torsional-vibration phenomena. He states that his paper is limited to showing how the RCA oscillograph is used to indicate a high-speed diesel engine. He explains how the RCA pressure-pickup unit utilizes the piezo-electric properties of quartz crystals.

Advantages of this type of equipment in engine indications are given as:

1. Zero time lag.
2. No distortion from heat.
3. Simple electrical calibration of any pressure at any point in the cycle.
4. Accurate location of all pressure phenomena with respect to any reference point.
5. Easy conversion of pressure-time cards to rate-of-pressure-time diagrams with very little distortion in amplitude or phase.
6. Through suitable mountings the quartz crystal pickup unit can be used to register almost any varying pressure phenomena in addition to cylinder pressure.

Discussion

After drawing attention to several shortcomings of electrical indicators, Prof. K. J. DeJuhasz of The Pennsylvania State College suggested means to eliminate them. The spherical shape of the screen makes it difficult to take a contact tracing of the diagrams, he pointed out in his prepared discussion. A plane or, at least, a cylindrical screen might be obtained by means of a mirror-oscillograph, he suggested.

The amplifiers contribute their share to the uncertainties of calibration, Prof. DeJuhasz believes. Where constant calibration is not expedient, he recommended incorporation of a device that would permit calibration immediately before and after taking diagrams simply by throwing a switch.

He concluded by describing an optical type of indicator equipped with a cylindrical screen that has been developed at The Pennsylvania State College.

Replying to comments and questions by C. E. Grinsted and Robert N. Frawley of General Motors Research, A. F. Robertson, University of Wisconsin, and G. T. Stanton, Electrical Research Products, Inc., Mr. Williams explained that the instrument was single-shielded against electrical disturbance and could be double-shielded if necessary.

Duration of Combustion in a Commercial Diesel Engine – **A. F. ROBERTSON, R. A. ROSE and G. C. WILSON, University of Wisconsin.**

NOT only does a high-cetane diesel fuel start to burn earlier in the cycle due to its shorter ignition-lag period, but it continues to burn longer during the expansion stroke than does a low-cetane fuel, the authors announce. This and other findings, they explain, are the results of an investigation of the effect of fuel quality and injection advance angle on ignition lag and combustion duration in a 4-cycle high-turbulence diesel engine. The same photo-electric combustion indicator, developed at the University of Wisconsin, was used, they point out, as was described previously before the Society, with the exception of several improvements. Combustion characteristics of 27 different fuels were determined by studying the oscillograms for more than 5000 engine cycles obtained at a film speed of 60 fps.

From dynamometer tests run both on 1-cyl and 6-cyl 4-cycle diesel engines, fuel rates were obtained from six different fuels varying in cetane number from 25 to 87.

A comparison of the test data from an open-head engine with that obtained from the separate-chamber type shows that the high turbulence in the latter engine had no direct effect on ignition lag, they report, although it is noted that greater heat losses due to turbulence caused slight changes in the shape of the ignition-lag curves.

Discussion

"According to the authors' paper, burning of a low-cetane fuel may end as early as 30 deg after top-center," stated Prof. P. H. Schweitzer, The Pennsylvania State College, in prepared discussion read by Prof. Charles W. Good, University of Michigan; "yet the same low-cetane fuels show high fuel consumption. The authors' explanation for this paradox is that the 'fire goes out before combustion is completed.' This condition is ascribed to a chilling action during expansion while combustion is still in progress."

This explanation is "not convincing," Prof. Schweitzer contended, giving the reasons for his belief that there is no considerable chilling action during expansion in a diesel engine and, therefore, no reason for the flame to be extinguished because of this effect.

The importance of ignition lag in small high-speed diesel engines was stressed by T. M. Robie, Fairbanks, Morse & Co. He expressed concern over the "more or less static attitude of the oil companies about the ignition-lag problem" which, he contended, was the cause of rough running in high-speed diesels.

Was it really combustion the authors measured, or just incandescence? asked A. W. Pope, Jr., Waukesha Motor Co.

Replying to Prof. Schweitzer first, Mr. Robertson stuck to his guns that there was a chilling effect, and that it is caused by the flame being extinguished due to the rapid expansion with the high piston speed. Before we can answer Mr. Pope's question, he explained, we must first have an acceptable definition of combustion. We assume that it is liberation of energy and, if there is enough radiation to affect the photocell, it is liberating energy, he concluded.

In a short intermission between papers the Diesel Engine Activity held a brief business meeting for the election of its nominating committee for 1939.

News of the Society

Relationship of BMEP To Economy Discussed

● Philadelphia

On Dec. 14 the Philadelphia Section's roster of speakers eminent in automotive society was embellished further by the addition of F. S. Baster to the names of those who have preceded him on the 1938-1939 program. Mr. Baster, who has advanced since his graduation in 1918 from the Case School of Applied Science to the position of chief engineer of the White Motor Co., put and soundly discussed the question "Why Not 125 BMEP for an L-Head Engine" before more than 100 local SAE men and their guests. Among the latter were 25 students from the engineering school of the University of Pennsylvania. Presiding as chairman for the session was Charles O. Guernsey, vice-president of the J. G. Brill Co.

Inasmuch as Mr. Baster's paper is published in full in this issue of the Journal (p. 72-76, Transaction Section), only the highlights will be mirrored in this account. "The gasoline engine is essentially a heat engine," he said, "and it is only natural to assume that its behavior should be materially affected by the control of the generated heat. If we were to augment the premise so as to include the preparation of the mixture for burning, then the axiom would for all practical purposes be true."

He also pointed out that the goal of exceedingly high output is not solely to propel a larger payload faster, but more particularly for the invariably associated reduction in specific fuel consumption, and especially that at road-load power.

"It is evident," Mr. Baster concluded, "that distribution, combustion and cooling are still the fundamentals in engine design; nevertheless, it is the regard we have for the importance of the allied factors which actually produces the ultimate in output and brings our prediction of 125 bmep within the realm of practical possibilities."

Some very lively discussion followed presentation of the paper. To the question: "What in your opinion is the best speed for maximum torque?" Mr. Baster replied, "the higher you can make it the better off you are." The speaker was asked if he had any information on copper-alloy cylinder heads. He gave his opinion that the adoption of copper-alloy heads is a step in the right direction although, he added, "I won't agree that it's the answer." Comments on the advantages and disadvantages of steam cooling were requested. Couching his reply in general terms, the speaker stated that steam cooling is "perfectly all right" and can be advantageous for certain parts of the internal-combustion engine. Some discussion followed on the possible utilization of "superfinish." The opinion was expressed that it would solve a great many problems with regard to heat transfer. The superfinishing of such parts as valve stems and guides was advanced as a means of achieving lower operating temperatures at these points. Another interrogator wished to know whether carbon deposition is more likely to occur at a temperature of 200 or 400 F. The reply given, in effect, was that "it depends on the viscosity of the oil." It was also pointed out, in reply to this question, that carbon doesn't form as readily on aluminum as it does on cast iron. The question was raised as to whether different oils produce carbons with different adhesion properties. It was said in answer that certain tests have indicated that "80% of deposits on the top of pistons is road dust."

Among those who took part in the discussion were: D. J. Macklin, Autocar Co.; P. M. Heldt, *Automotive Industries;* C. M. Billings, Gulf Oil Corp.; J. P. Stewart, Socony-Vacuum Oil Co.; Mr. Guernsey; Adolf Gelpke, Autocar Co.; J. G. Williams, Superior Engine Division, National Supply Co.; Lt. H. K. Perrill, U. S. Navy; and R. H. Randall, U. S. Navy.

Germany's Air Force Strongest, Says Wright

● So. New England

If we rate Germany's fighting air force as 10, then those of other nations would be rated about as follows: Russia – 7; Italy – 6; England – 4; United States – 3; and France – 1 or 2, was the opinion stated by T. P. Wright at the New England Section's Jan. 4 meeting.

Mr. Wright, who is vice-president and director of engineering, Curtiss-Wright Corp., told the members of observations made on recent trips to Europe. When he was abroad in 1935, he reported, England, France, Germany, and Russia had not advanced very far in aviation as compared to the United States. In 1936, he said, there was marked improvement, and in 1938 he found that in many respects these countries were superior to the United States in aviation production and experimental work. We still lead in commercial aviation, he added.

Germany, he estimates, has 12,000 planes in service and 200,000 people employed in aircraft production; England, 3000 to 3500 planes in service and 100,000 people producing planes; and the United States, 3000 or less planes in service and only 40,000 aircraft workers.

The United States, Mr. Wright declared, must make a concerted effort to increase its production of aircraft. He emphasized that we should do it in an orderly fashion without rushing headlong into production as some of the European countries have been forced to do because of their vulnerability to attack from neighboring countries.

The favorable locations of German cities as compared with those of England were illustrated by Mr. Wright when he explained that a German plane could leave the German coast and in one hour cover the 300 miles to the English coast and in another 10 min bomb London. An English plane could cross the water in the same length of time, he said, but would take an additional hour to cover the distance from the German coast to that country's principal cities.

While the United States is ahead in wing and fuselage construction, European countries are in advance of us in regard to engines, Mr. Wright reported. He noted particularly that England is using quite a number of liquid-cooled engines and that production of sleeve-valve engines is about four to one over poppet-valve engines. Germany, he said, is using fuel-injection engines, with the injection in the manifold rather than in the cylinder head, which have a cruising range beyond 1500 miles. Germany also leads, he said, in the caliber of cannon mounted on fighting planes.

England, he added, is also doing extensive experimental work on propellers; substituting magnesium for aluminum, and developing a hollow-wood type. There is also great interest in the helicopter, he reported.

Field Editors

Baltimore – N. L. Dods
Buffalo – C. W. Georgi
Canadian – Warren B. Hastings
Chicago – Austin W. Stromberg
Cleveland – W. A. Maynard
Dayton – R. H. Henry
Detroit – William F. Sherman
Indiana – Harlow Hyde
Kansas City – No Appointment
Metropolitan – Grosvenor Hotchkiss
Milwaukee – L. M. Kanters
New England – J. T. Sullivan
No. California – R. W. Goodale
Northwest – R. J. Hutchinson
Oregon – Sid Hammond
Philadelphia – H. E. Blank, Jr.
Pittsburgh – Murray Fahnestock
St. Louis – A. R. Burgess
So. California. – W. A. F. Millinger
So. New England – Edwin S. Sessions
Syracuse – C. T. Doman
Washington – P. R. Wheeler

Outlines Engineering Set-Up at Chevrolet

● Baltimore

Confidence, both within and outside of the department, is of primary importance in an engineering organization, Chief Engineer J. M. Crawford, of Chevrolet, declared at the Baltimore Section meeting, Dec. 1. He was speaking on "Factors Influencing Engineering Organization," and based most of his remarks upon the engineering department set-up of his company.

He explained how test reports are distributed at Chevrolet and pointed out how this method serves as a check to prevent any engineer or engineering group from "putting over" unsound ideas. The distribution of test reports also prevents rumors as to results and duplication of effort, he averred.

Mr. Crawford also stressed the importance of contacts between the engineering organization and the purchasing, parts and accessories, sales, mass selling, and advertising departments, and told how these contacts are maintained at Chevrolet.

Using numerous slides the speaker traced trends since 1928 in car design, frames, performance, economy, maximum speed, weight, and other factors. He used the rear axle as an

example to illustrate how engineering changes are dependent upon ability to work out new manufacturing processes. He also pointed out that rear-axle changes have permitted a reduction in axle weight in spite of increased car weight and engine torque.

At the conclusion of Mr. Crawford's paper two technical motion pictures were shown.

Record Crowd Hears Shoemaker on Diesels

● So. California

Diesels must compete with gasoline engines in all fields and equal all of its desirable characteristics, F. G. Shoemaker, chief engineer, Detroit Diesel Engine Division, General Motors Corp., said in his talk on "Automotive Type 2-Cycle Diesel Engines," presented before one of the Southern California Section's biggest meetings, Dec. 13. More than 350 were on hand when Dr. Ulric Bray, fuels and lubricants vice-chairman of the Section and sponsor of the program, introduced the speaker.

Early in his talk, Mr. Shoemaker paid tribute to C. F. Kettering, GM vice-president in charge of research, for his leadership in developing the 2-cycle diesel.

After stating that most people want diesels because of savings in direct fuel costs, Mr. Shoemaker said that if the operator does not keep track of such costs, he will not know whether diesels are the answer. He pointed out that the 4-cycle engine uses a portion of its cycle in non-power loading, and that while the 2-cycle engine uses all the cycle for power, it must have a blower.

The question of smoke came to the fore in discussion. Mr. Shoemaker noted that General Motors has safeguarded its engine against the operator feeding more fuel to gain power over the engine's rating, by limiting the feed of the injectors to the capacity of the engine. Proper combustion and correct loading, he said, result in a smokeless engine.

Answering the question, "If a 2-cycle diesel engine is good, why not a 2-cycle gasoline engine?" Mr. Shoemaker said that there is no stratifying of the incoming charge in a diesel; you can't burn a mixture such as you get in a 2-cycle gasoline engine without getting into ignition trouble.

The General Motors 2-cycle diesel engine, he said, does not require a special fuel and can use a number 3 or a 40 cetane fuel. They can use any marketable SAE 30 oil for lubrication, he added, explaining that the piston is so designed as not to overheat the oil.

When to shift gears, the author stated, is not a problem of the manufacturer, but one which the operator has to meet.

Active Discussion Follows Forum On Modern Trends in Motor Fuels

● Chicago

"Keeping Up to Date in Motor Fuels" was the theme of a highly instructive symposium on motor fuels presented jointly by five speakers at the Tally-Ho Club of the Medinah Club, Chicago, on December 6, before approximately 200 guests and members of the Chicago Section. The five speakers introduced by Meeting Chairman William H. Hubner were: Dr. Gustav Egloff, director of research, Universal Oil Products Co.; Dr. D. P. Barnard, associate director of research, Standard Oil Co. of Indiana; W. G. Ainsley, manager, automotive testing laboratories, Sinclair Refining Co.; T. B. Rendel, director, engine research laboratory, Shell Petroleum Corp.; and Thomas H. Risk, automotive engineer, The Pure Oil Co.

Analyzing tractor fuel trends, Dr. Barnard, the first speaker, pointed out that tractor fuels are heavier than gasoline principally in order that the user may be exempt from present gasoline taxes averaging about 5¢ per gal. Density for this type fuel, he pointed out, is 1.9 greater than for gasoline, while octane numbers average about 30. Engine output is lower with tractor fuel, he declared, than for gasoline (80% load factor). On the other hand, while the cost is about 25% less per gal, he pointed out, the volumetric consumption of tractor fuel is about 14% greater than for gasoline. Whether the lower gallon cost of such fuel, therefore, is a gain must be determined by such factors as equipment capacity, labor costs, and maintenance costs, the speaker declared.

The tractor operator, while benefiting by the reduction in fuel cost, must accept such operating disadvantages as lack of flexibility, slightly greater labor cost in warming up and heat-control manipulation, together with greater inconvenience of operation generally not tolerated by the passenger-car driver, Dr. Barnard indicated.

Prospect of supplying higher knock-rating tractor fuels is not promising, Dr. Barnard declared, since the general trend is for all hydrocarbons in the tractor fuel range to be more prone to knock than the corresponding gasoline components.

Discussing diesel fuel trends, Mr. Ainsley pointed out that investigation is being directed at the present time towards diesel fuel in the gas-oil range. Study and analysis of diesel fuel specifications, he declared essential because of their wide variation. Such specifications have been written by the engine manufacturer, the engine user, and the refiner, he said and, while they are tending to move closer together in their recommendations, there still remains much to be done towards greater uniformity.

A major key to the problem is the user who, in the final analysis, will be the judge of both fuel and engine, the speaker said. The refiners may be wrong on what constitutes a good diesel fuel, but they seem to agree on what is the most logical fuel to produce, he added.

Discussing the properties of diesel fuels, the speaker commented that, with a drop in the cetane number of these fuels, there is a drop in the horsepower as shown in engine tests. High-cetane fuels, he declared, may do negative work by building up pressure before dead center. Charts were presented by the speaker to illustrate this aspect of variation in fuel specifications.

To facilitate investigating of fuels of the same physical characteristics but with different cetane values, Mr. Ainsley called attention to the use of a dope, only a small percentage of which is required to increase the cetane number.

In a discussion of recent developments in aircraft fuels, Mr. Rendel pointed out that development of aircraft fuels of 100-octane rating has disclosed the need for greater knowledge concerning the full-scale behavior of fuels of 83 to 100-octane number or higher. Current knock-testing methods, he declared, lean towards the ASTM method, but that results from the use of this and other testing methods show a poor correlation for fuels over 87-octane number. A new knock-testing method, which it is hoped will predict more satisfactorily full-scale engine behavior than either the ASTM or Army methods, the speaker said, is now being developed by the aviation fuels division of the CFR for fuels over 87-octane number.

Engines using 100-octane fuel, he pointed out, have shown a maximum power increase up to 25%, or a reduction in fuel consumption of about 12% in the case of a redesigned engine. In either case, he said, it would seem that the extra cost of the fuel is more than counterbalanced by the gain in power or fuel economy. In discussing the trend towards standardization in aviation-fuel specifications, Mr. Rendel said that there has been a reduction in the number of aviation fuels offered for commercial use of from 14 to 5 grades, but that still further improvement in this direction is needed in the effort to reduce the cost of aviation fuel.

Discussing gasoline-type motor-car fuels, Mr. Risk pointed out that motor-fuel and engine-design improvements go hand in hand. Increased engine speeds and increased volumetric efficiency by raising compression ratios, better

Speakers at Chicago Section's Fuel Symposium

Photos by Frank Bennett, Photo-Check Service

Dr. Gustav Egloff — T. B. Rendel — Dr. D. P. Barnard — W. G. Ainsley — Thomas H. Risk

valve and port design, have been coincident with the development of higher antiknock quality motor fuel, he emphasized. Tests of between 2000 and 3000 passenger cars during the past 10 years, when charted in comparison with engine-design improvement in the same period, produce curves of striking similarity, as revealed on slides which Mr. Risk projected on the screen.

Likewise reduction of price per gallon and increase in volatility were marked trends in motor fuels during this period, he pointed out. Higher volatility facilitates easy starting, better acceleration, and improved distribution to cylinders, the latter being particularly important with the greater number of cylinders in modern engines.

Motor fuels have increased approximately 20 octane numbers in the past 10 years, pointed out Mr. Risk. Future increases in antiknock quality will probably be due to increasing the antiknock value rather than adding increased amounts of cracked material, since the refiner is limited in the amount of cracked distillate that may be added to a finished fuel, he declared.

With respect to the use of substitute motor fuels, some highly interesting trends, as now being developed in Germany, England, France, Italy and other European countries, were cited by Dr. Gustav Egloff, who recently made first-hand observations of the attempts in these countries to utilize motor fuel supplies found in coal, vegetables, cereals, wood, natural gas, and oil shale. Subsidization in many cases is resorted to, he said, in order to stimulate such fuel use through taxes on imported motor fuels, partial elimination of taxes on these fuels and on the vehicles using them and, in some cases, direct part payment on the vehicles using them.

In Germany compressed gases in light-weight alloy cylinders (weight about 115 lb each) are being used for cars and trucks, he pointed out. The cost compared with a gallon of gasoline for city gas, motor methane, and propane-butane is 43, 41, and 61¢, respectively, he said. Italy is also replacing gasoline by a similar method at the rate of 40,000 tons of gasoline annually, the chief source of supply being a natural gas field near Milan. It is expected that in two years the above rate will be quadrupled, Dr. Egloff indicated.

Consumption of power alcohol in Europe, the speaker declared, increased from 59,000 tons in 1930 to 648,000 tons in 1936. Attitude of the governments toward the use of power alcohol has undergone a change because of the fear of war, he emphasized, because of the impossibility of providing the necessary alcohol for both motor fuel and war supplies at the same time.

Especially designed wood and coal-gas producer vehicles are now being used and promoted in European countries, he said, in order to conserve oil supplies or to decrease the amounts necessary to import. Dried wood for this use is sold in packages weighing from 30 to 60 lb and in sacks weighing about 82 lb. Charcoal is used to start the motor and the cost is 70¢ for 33 lb.

The cost for 25 lb of wood equivalent to distance performance of 1 gal of gasoline is 16¢ in Germany, Dr. Egloff estimated, which gives the effect of a cheap fuel. This is because subsidies are given wood users over gasoline, such as absence of taxes on wood, one-half the gas tax rate to wood-burning vehicles, and a high gasoline tax which amounts to 36¢ per gal. The government also, he said, will assume part of the expense of converting a vehicle from the gasoline to the wood-burning type, ranging from $300 to $500. Producer-gas vehicles also operate on charcoal and anthracite, but the operating difficulties are much greater than with wood, he said.

Utilization of shale oil deposits in Europe are also under way, the speaker pointed out. The cost of production is about 15¢ per U. S. gal in Great Britain. Experimental work is also going on with such substances as ammonia, acetylene, and hydrogen for substitute fuels. In Italy synthetic ammonia has been used as a motor fuel substitute, he said, but the low heating value and high cost do not encourage its wide use. Acetylene and hydrogen are also being tried as motor fuel but the results are not very promising.

In the further discussion which followed, Ray Kelly, United Air Lines, commented on the possibilities of utilizing 100-octane aviation fuel on present airplane equipment modified to use this type of fuel. He stated that a recent survey made by his company based on its average operations and assuming only a 4¢ premium for 100-octane fuel over 87-octane fuel indicated that a net loss of $35,000 per year would be incurred. Therefore, in order to be economically possible, the premium for 100-octane fuel would have to be well under 4¢ in order to break even. In fact, to break even on the basis of this analysis the premium could not be more than 3 1/3¢.

On the other hand, it is believed that the airlines do realize that lower specific fuel consumptions can only be obtained through the utilization of higher octane fuels, and the analysis which has been made on the basis of present conditions should not be construed as an indication that United Air Lines feels that the limit has been reached in the use of higher octane fuels for commercial air transport. The point that Mr. Kelly made clear was that it would not be economically sound for his company to change to 100-octane fuel at this time unless the premium can be reduced much below the figure which has been generally published by the oil companies.

Fred L. Faulkner, Armour & Co., raised the question of waste in using a 70-octane or better regular-grade highly volatile gasoline in operating older-type vehicles designed for a 55 to 65-octane fuel. He pointed out that many operators of commerical vehicles would welcome the use of a 65-octane non-leaded fuel but that it was unobtainable today from the regular sources of fuel supply. Dr. Barnard, in replying to this question, pointed out that 65-octane fuel could easily be supplied in tank-car quantities, but the real difficulty was the problem of distribution, the average fuel distributor today not being in a position to handle it because of the limited demand and the extra

(*Continued on page 47*)

SAE *Coming* EVENTS

National Aeronautic Meeting

March 16-17 Washington, D. C.
Hotel Washington

World Automotive Engineering Congress

May 22-June 8

Baltimore – Feb. 2

Longfellow Hotel; dinner 6:30 p.m. Piston-Ring Performance and Its Relation to Lubrication – A. L. Beall, research engineer, Wright Aeronautical Corp.

Buffalo – Feb. 14

Hotel Statler; 8:00 p.m. Joint meeting with the Engineering Society of Buffalo. Subject – The St. Lawrence Waterway Project.

Canadian – Feb. 15

Royal York Hotel, Toronto; dinner 7:00 p.m. Guest Speaker – W. J. Davidson, Diesel Engine Division, General Motors Corp., and President, SAE.

Chicago – Feb. 7

Medinah Club; dinner 6:30 p.m. Factors Affecting Air-Conditioning Design for Vehicles – Edward L. Mayo, vice-president, Bishop & Babcock. Recent Problems in Carburetor Development – W. A. Gebhardt, research engineer, Bendix Products Division, Bendix Aviation Corp.

Cleveland – Feb. 13

Cleveland Club; dinner 6:30 p.m. Two-Cycle Diesel Engines in Trucks and Buses – W. S. Fisher, General Motors Corp.

Detroit – Feb. 6 and 27

Hotel Statler, Feb. 6, meeting 8:00 p.m.; subject – Flame Propagation. Feb. 27, dinner 6:30 p.m.; subject – Aircraft Development.

Indiana – Feb. 9

Antlers Hotel, Indianapolis; dinner 6:30 p.m. Advancements in Pistons and Valves – A. T. Colwell, vice-president in charge of engineering, Thompson Products, Inc.

Kansas City – No Meeting

Metropolitan – Feb. 16

Hotel New Yorker, New York City; dinner 6:30 p.m. Subject – Super Aircraft.

Milwaukee – Feb. 10

Milwaukee Athletic Club; dinner 6:30 p.m. New Methods of Power Transmission – Martin P. Winther, vice-president, Dynamatic Corp.

New England – Feb. 14

Engineers Club, Boston; dinner 6:30 p.m. The Application of Polaroid to Automotive Equipment – Dr. Martin Graham, the Polaroid Corp.

Northern California – Feb. 11

Terrace Ball Room, Fairmont Hotel, San Francisco; dinner 6:30 p.m. Annual Dinner Dance and Entertainment.

Northwest – Feb. 10

Mayflower Hotel, Seattle; dinner 6:30 p.m. Pressure Induction in Gasoline Engines – Prof. W. H. Paul, Department of Mechanical Engineering, Oregon State College.

Oregon – Feb. 17

Congress Hotel, Portland. Welding as Used in the Building of Buses – Rowland S. Rose, chief engineer, Wentworth & Irwin, Inc.

Philadelphia – Feb. 8

Engineers Club; dinner 6:30 p.m. Filtering Fallacies – Austin M. Wolf, consulting engineer.

Pittsburgh – Feb. 21

Ladies' Night.

St. Louis – Feb. 22

Public Service Co., Forest Park; dinner 6:30 p.m. Diesel Engine Meeting.

Southern New England – Feb. 1

Bond Hotel, Hartford, Conn.; dinner 6:30 p.m. Subject – Welding in Automotive Engineering – Everett Chapman, president, Lukenweld, Inc.

Syracuse – No Meeting

Washington – Feb. 14

Cosmos Club, Washington, D. C.; dinner 6:30 p.m. Joint meeting with American Society of Mechanical Engineers. Subject – Diesel Engines.

About SAE Members:

RAY B. HOOVER has been elected president of the Shafer Bearing Corp., of which he previously was vice-president and general manager.

WILLIAM A. KIMSEY is affiliated with the Le Blond Machine Tool Co., Cincinnati, as experimental engineer. He had been chief engineer of the Ken-Royce Aircraft Engineering Co., Kansas City, Kan.

JAMES S. MARVIN, assistant general manager of the Automobile Manufacturers Association and manager of the AMA traffic department, has been appointed a member of a special committee of the National Industrial Traffic League to consider the railroad problem.

LON R. SMITH, formerly owner of the Lon R. Smith Sales Co., Indianapolis, is now affiliated with the Hercules Motors Corp., Canton, Ohio, with which he previously had been associated for a number of years.

C. M. YOUNG, president, L. A. Young Spring & Wire Corp., recently was elected president of the Milwaukee Junction Manufacturers Association.

GEORGE W. KUHLMAN, general manager of the Heil Co.'s eastern factory at Hillside, N. J., has been elected a vice-president of the company. He has been associated with the organization since 1919.

WILLIAM A. SEARS is supervisor of safety education for the Chicago Board of Education. He continues to be with the Lane Technical

W. A. Sears
Takes Safety Post

School of that city in charge of automotive and aviation departments.

R. F. RUNGE, vice-president, SKF Industries, Inc., recently was elected vice-president of Metal Manufacturers Association of Philadelphia at that organization's 35th Annual Meeting.

RANDALL BARTON is a student engineer in the Detroit Diesel Engine Division of General Motors Corp.

SAE Appointments

F. K. GLYNN, engineer, operation and maintenance of automotive equipment, American Telephone & Telegraph Co., as SAE representative on the Mechanical Standards Committee of the American Standards Association. . . . **AUSTIN M. WOLF,** consulting engineer is his alternate. . . . **W. L. BARTH,** standards engineer, General Motors Corp., as SAE representative on the Sectional Committee (B-14) on Dimensions of Machine Pins, functioning under ASA procedure. . . . **E. H. DIX,** chief metallurgist, Aluminum Research Laboratories, Aluminum Co. of America, as SAE representative on the Joint Coordinating Committee on Corrosion of the American Society for Testing Materials.

W. LAURENCE Le PAGE is president of the recently organized Platt-Le Page Aircraft Co., Philadelphia. He was previously consulting engineer for Day & Zimmermann, Inc., of the same city.

ARTHUR P. EMMERT has resigned his position as production superintendent of the Waltham Watch Co.

ROBERT A. HERMANN is in the inspection department of the Glenn L. Martin Co. He was formerly inspector with the Hall Aluminum Aircraft Corp.

Since the first of the year **FRANK SCHUBERT** has been assistant general manager of the Houde Engineering Corp., Buffalo, following two years as a sales executive with the

Frank Schubert
Advanced by Houde

company. He was previously with the Bearings Corp. of America as assistant to the president. Earlier Mr. Schubert had charge, as consulting engineer and works manager, of planning, equipping, and operating the First State Anti-Friction Bearing Plant at Moscow, Russia. With 15,000 employees and a capacity of from 24,000,000 to 30,000,000 bearings per year, this plant is the largest of its kind in the world.

PAUL W. LITCHFIELD, president, Goodyear Tire & Rubber Co., is directing plans in Akron for observance of the 100th anniversary of the vulcanization of rubber, Feb. 20-23. The process was discovered in 1839 by Charles Goodyear.

At the first of the year **GEORGE H. SCRAGG** became advertising manager of the White Motor Co., Cleveland. Before that he was associated with the Brockway Motor Co., Inc., of New York.

G. H. Scragg
White's Advertising Manager

JULIUS STEINDLER has joined Engis Ltd., London, England, as managing director. He was previously located in Vienna.

W. C. CANANN has been advanced from district manager to assistant to the general manager of the Bendix-Westinghouse Automotive Air Brake Co., Pittsburgh.

After spending a month in the United States, **G. W. HALL,** assistant chief engineer, Fairey Aviation Co., Ltd., Middlesex, England, sailed for home early last month. He visited SAE Headquarters while in New York.

PIERRE STUART de BEAUMONT has joined the Packard Motor Car Co. as junior engineer. Previously he was draftsman with Henry R. Hinckley, Inc.

GARLAND C. RICHARDSON has been elected president of the Petroleum Motor Transport Association of Oklahoma. He is transportation superintendent of the Indian Territory Illuminating Oil Co., Bartlesville, Okla.

MICHAEL J. ROSS has joined Wagner Electric Corp., St. Louis, Mo., as automotive draftsman. He was formerly in the St. Louis Airplane Division of Curtiss-Wright Corp.

LAURIE C. SMITH is with the Bureau of Engineering, Navy Department, as assistant mechanical engineer in the diesel division, at Washington. He was draftsman with the Pacific Gas & Electric Co., San Francisco.

KINGSLAND HOBEIN, formerly test engineer with Wright Aeronautical Corp., Paterson, N. J., is engineering assistant with Curtiss-Wright Corp., Washington.

New Councilor Elected for 1939

F. K. GLYNN (M '23) serves on the SAE Council for 1939. He was elected to complete the unfinished term of W. J. Davidson, who resigned upon his election as president of the Society.

Mr. Glynn, who is automotive engineer, operation and maintenance of automotive equipment, American Telephone & Telegraph Co., has been affiliated with the Bell System since 1919. At that time he recently had received his M.E. degree from Syracuse University. He was named engineer of motor vehicles of the New York Telephone Co. in 1923, and three years later took his present position.

In 1930 Mr. Glynn was elected a Councilor and after serving one year, resigned in 1931 when elected SAE vice-president representing the Transportation & Maintenance Activity. He is a past chairman of the Metropolitan Section and has served on numerous national and sectional committees of the Society, heading the Membership Committee for several years. Since 1936 he has been chairman of the National Sections Committee. He is also chairman of the Motor Truck Rating Committee and holds membership on the Advertising, Student, and Brake Committees, and several divisions of the Standards Committee. Mr. Glynn represents the Society on the Standards Council and the Mechanical Standards Committee of the American Standards Association. He is also SAE alternate on the Highway Traffic Standards Committee.

New Members Qualified

These applicants who have qualified for admission to the Society have been welcomed into membership between Dec. 15, 1938, and Jan. 15, 1939.

The various grades of membership are indicated by: (M) Member; (A) Associate Member; (J) Junior; (Aff.) Affiliate Member; (SM) Service Member; (FM) Foreign Member.

Buffalo Section

KRUCZEK, ANTHONY S. (J) detail draftsman, Curtiss Aeroplane Division, Curtiss-Wright Corp., Vulcan St., Buffalo (mail) 144 Rees St.

Cleveland Section

PITTENGER, JOHN M. (A) editor, *Brake Service*, Babcox Publications, Inc., 31 N. Summit St., Akron, O.

Detroit Section

BARIT, A. EDWARD (A) president, general manager, Hudson Motor Car Co., 12601 E. Jefferson Ave., Detroit.

Indiana Section

BAKER, CHARLES HENRY, JR. (J) Warner Gear Division, Borg-Warner Corp., Muncie, Ind. (mail) 2108 W. Jackson St.

Metropolitan Section

HEADDEN, WILLIAM P. (M) assistant supervising engineer, sales engineering department, Standard Oil Co. of N. J., 26 Broadway, New York.

NELIS, IRVIN F. (A) district manager, Bendix-Westinghouse Automotive Air Brake Co., Pittsburgh, Pa. (mail) 3420 Empire State Bldg., New York.

Milwaukee Section

DAVIS, C. LYLE (A) district manager, Macmillan Petroleum Corp., 530 W. Sixth St., Los Angeles, Calif. (mail) 1420 E. Capitol Dr., Apt. 104, Milwaukee, Wis.

New England Section

FLYNN, DONALD S. (M) assistant division manager, Ethyl Gasoline Corp., 603 Statler Bldg., Boston.

WILKINSON, JAMES WILLIAM (M) chief engineer, Fleming Mfg. Co., 55 Pawtucket Ave., East Providence, R. I. (mail) 206 Waterman Ave.

Northern California Section

KADOW, WALTER W. (A) service manager, White Motor Co., 1500 Mission St., San Francisco.

Northwest Section

HOWE, THEODORE C. (A) superintendent of equipment, North Coast Transportation Co., 200 Central Terminal, Seattle, Wash. (mail) 922 Virginia St.

Philadelphia Section

THERMOID CO. (Aff.) Trenton, N. J. Representatives: Allen, D. P., manager, textile division, Detroit; Main, F. L., manager, Detroit office; Ogren, C. F., assistant chief engineer; Schell, C. A., chief engineer; Schluter, F. E., president.

Foreign

BOOTH, ARTHUR GEORGE (FM) chief chassis engineer, Humber, Ltd., Coventry, England (mail) 3 North Ave., Stoke Park.

BROEZE, J. J. (FM) acting manager, N. V. de Bataafsche Petroleum Maatschappij, The Hague, Holland (mail) Proefstation "Delft" Haagweg 126, Delft, Holland.

GRAHAM, JOHN WILKINSON (M) representative, export sales department, Union Oil Co. of Calif., P. O. Box 101, Durban, South Africa.

HALLIDAY, IAN ANDREW WOOD (A) assistant engineer, Birmingham & Midland Motor Omnibus Co., Ltd., Bearwood Road, Smetwick St., Birmingham, England (mail) 24 Wadhurst Road, Edgbaston, Birmingham 17.

MACIVER, PATRICK ROLLAND (FM) senior draftsman, jig and tool drawing office, General Aircraft, Ltd., Feltham, Middlesex, England (mail) 83 Maswell Park Road, Hounslow, Middlesex.

Applications Received

The applications for membership received between Dec. 15, 1938, and Jan. 15, 1939, are listed herewith. The members of the Society are urged to send any pertinent information with regard to those listed which the Council should have for consideration prior to their election. It is requested that such communications from members be sent promptly.

Buffalo Section

MARQUARDT, WILLIAM C., junior engineer, Houde Engineering Corp., Buffalo.

Canadian Section

ELLIS, A. STANLEY, general service manager, Ford Motor Co. of Canada, Ltd., Windsor, Ont.

HARVIE, EDGAR, manager, McCord Radiator & Manufacturing Co., Walkerville, Ont.

IRWIN, PAUL MANSELL, manager, manufacturer's sales, Dominion Rubber Co., Ltd., Kitchener, Ont.

Chicago Section

DAVIS, HARRY G., director of research, Farm Equipment Institute, Chicago.

PAINE, WILLARD B., chief engineer, B-K Division, Bendix Products Division, South Bend, Ind.

PEYTON, DENNIS BROWN, engine laboratory, Standard Oil Co. (Ind.), Whiting, Ind.

SCRANTOM, WILLIAM G., manager, motor transport, marketing division, Pure Oil Co., Chicago.

WHITING, EDWARD M., vice-president, Pheoll Mfg. Co., Chicago.

Cleveland Section

BAKER, JOHN BURTON, assistant chief engineer, Timken Roller Bearing Co., Canton, O.

CORNELL, MEAD, president, Cornell Machine Co., Cleveland.

REAGAN, J. E., general service manager, Timken Roller Bearing Co., Canton, O.

Detroit Section

BRANDT, E. FRED, assistant superintendent, machine shop, Hudson Motor Car Co., Detroit.

DAHLQUIST, HENRY, sales representative, 692 Henrietta St., Birmingham, Mich.

DECAVITTE, FRANK L., chassis engineer, Plymouth Motor Corp., Detroit.

DEREMER, FLOYD E., chief engineer, Oldberg Mfg. Co., Detroit.

GOULD, JAY H., assistant general manager, General Spring Bumper, Division of Houdaille-Hershey Corp., Detroit.

HOFFMAN, PAUL BERNARD, assistant sales manager, American Brakeblok Division, Detroit.

MARCHANT, HARRY A., standards engineer, Chrysler Corp., Detroit.

PLASTERER, KENNETH C., chief inspector, Olds Motor Works, Lansing, Mich.

SULLIVAN, JOHN, salesman, Houde Engineering Corp., Detroit.

TUTTLE, STANLEY B., project engineer, Detroit Diesel Engine Division, General Motors Corp., Detroit.

WALTER, KARL ADOLF, draftsman, Fisher Body, Detroit.

WELCH, WENDELL H., assistant director of service, Chrysler Corp., Export Division, Detroit.

WELKER, EUGENE JOHN, sales engineer, Welker Machinery Co., Inc., Detroit.

WILD, ARTHUR, sales manager, aircraft division, Continental Motors Corp., Detroit.

ZEEB, ELMER G., chief draftsman, Chrysler Corp., Highland Park, Mich.

Indiana Section

BRENNEKE, ARTHUR M., sales engineer, Perfect Circle Co., Hagerstown, Ind.

REEVES, PAUL B., vice-president, Reeves Pulley Co., Columbus, Ind.

Kansas City Section

COLEMAN, R. C., vice-president and manager, American Safety Tank Co., Kansas City.

Metropolitan Section

CAMPBELL, JAMES E., assistant to president, Metropolitan Distributors, Inc., New York.

CARLSEN, FRED E., sales engineer, International Harvester Co., New York.

DELANEY, MYRON E., sales manager, Halowax Corp., New York.

DUGUID, H. ALAN, assistant engineer, J. V. W. Corp., Newark, N. J.

EELLS, MILTON MERWIN, vice-president, Breeze Corp., Inc., Newark, N. J.

GORDON, BRITTON L., sales engineer, Halowax Corp., New York.

GROSS, FRED W., vice-president, treasurer, Schwartz & Nagle Corp., New York.

HARTBRODT, FRED JOHN, maintenance foreman, R. H. Macy & Co., New York.

KUHN, W. E., manager, technical and research division, Texas Co., New York.

MATTERSDORF, GUSTAV, brake engineer, 61 Lismore Road, Lawrence, L. I., N. Y.

MERRILL, WILLIAM C., JR., president, E. R. Merrill Spring Co., New York.

MORRISON, JOHN F., senior mechanical engineer, U. S. Navy Yard, Brooklyn, N. Y.

PRIESTLEY, WILLIAM J., vice-president, Electro Metallurgical Co., New York.

SEEBERGER, WILLIAM H., William H. Seeberger's General Motor Service, Brooklyn, N. Y.

WHITMAN, EDWIN W., shop superintendent, Houpert Machine Corp., Long Island City, N. Y.

WILLIAMS, ROBERT N., automotive engineer, Sun Oil Co., New York.

WITTNEBERT, FRED R., equipment engineer, Sperry Products, Inc., Hoboken, N. J.

Milwaukee Section

FLEMING, HARRY L., sales manager, Warner Electric Brake Manufacturing Co., Beloit, Wis.

WINCHESTER, ROGER F., paint department, Fisher Body, Janesville Division, General Motors Corp., Janesville, Wis.

New England Section

DINUCCI, ANTHONY V., automobile instructor, Waltham Trade School, Waltham, Mass.

(*Concluded on page 48*)

Reports of Committees

Meetings Committee Report

DURING the 1938 administrative year, the meetings program of the Society comprised 12 meetings, exclusive of regular Section meetings. Statistics regarding sessions, papers and attendance at these meetings are given in the accompanying table.

The Annual Meeting and the Summer Meeting were under the general supervision of the Meetings Committee, the technical sessions being handled by the various professional activities. The Meetings Committee planned and carried through the arrangements for the Annual Dinner.

An innovation at the 1939 Annual Meeting was the devoting of an entire day (a morning session, an afternoon session and a dinner) to the subject of national defense. The Engineering Exhibit, which has become a feature of previous annual meetings, was held again at the 1939 Annual Meeting, giving members an opportunity to examine the new products of many companies.

The National Passenger Car Meeting held in Detroit in March was the first meeting sponsored in its entirety by the Passenger Car Activity Committee.

Meeting	Place	Date	No. of Sessions	No. of Papers	Attendance*
Aeronautic	Washington, D. C.	March 10-11	6	13	208
Passenger Car	Detroit, Mich.	March 28-30	5	9	381
Tractor	Milwaukee, Wis.	April 14-15	3	8	426
Transportation	Cleveland, Ohio	April 28-29	4	7	235
Summer	White Sulphur Springs	June 12-17	15	29	550
Truck, Bus and Railcar	Chicago, Ill.	Oct. 4-5	4	5	300
Fuels and Lubricants	Tulsa, Okla.	Oct. 6-7	6	9	94
Aircraft Production	Los Angeles, Calif.	Oct. 13-15	7	14	650
Transportation	Los Angeles, Calif.	Nov. 3-5	8	10	300
Annual Dinner	New York City	Nov. 14	1	1	1038
Transportation Engineering	New York City	Nov. 14-16	5	6	276
Annual	Detroit, Mich.	Jan. 9-13	19	33	

*Registered attendance at meeting; does not include dinner attendance.

The Sections have given able assistance during the past year in connection with the various National and Regional meetings held in their respective territories. The Meetings Committee takes this opportunity to thank the Chicago, Cleveland, Detroit, Metropolitan, Milwaukee, Northern California, Northwest, Oregon, Southern California and Washington Sections and the Tulsa Group for their fine cooperation.

—R. R. TEETOR, *Chairman*

Membership Committee Report

THROUGH the hearty cooperation of the National and Section Membership Committees and the splendid work of individual members, the Society can show an encouraging increase in membership for the year 1938.

Comparative figures are submitted below:

	1937 (as of Dec. 31)	1938 (as of Dec. 31)
Members	2963	3044
Associates	1451	1516
Juniors	423	452
Foreign Members	392	394
Service Members	87	88
Departmental Members	5	6
Affiliate Members	76	79
Additional Affiliate Member Representatives	37	42
	5434	5621
Enrolled Students	433	448
	5867	6069

737 applications were received for the calendar year 1938. We are particularly pleased with the caliber of applicants for membership and know that their affiliation will prove both valuable to them and to the Society.

The Membership Committee is deeply grateful to the Sections and those SAE members who have given so generously of their time in assisting us.

—R. N. JANEWAY, *Chairman*

Publication Committee Report

AS usual the activities of the Society have provided a wealth of material from which selections for publication have been made by the Publication Committee with the cooperation of special committees of volunteer readers representing each of the activities of the Society. The Committee would welcome any suggestions for the further improvement of any of the Society's publications. A brief summary of publication data has been prepared by the executive editor and is given below.

During the calendar year of 1938, 835 pages of text and 401 pages of revenue advertising were published in the Journal. Of the text pages, 549 or approximately 66 per cent consisted of papers and discussion; 528 of these pages were published in the Transactions Section. During the preceding year, 1937, 932 pages of text were published, of which 625 or 67 per cent consisted of papers and discussion. In 1937, there were published 637 pages of revenue advertising.

Sixty-seven complete papers, some with discussion, were published during the year 1938. In addition, there were published eight special articles, seven of which were part of a series of twelve on "Your Society."

In addition, 13½ pages of the Journal were devoted to printing for purposes of record, brief abstracts of all papers presented at the various general and Section meetings of the Society. This practice was begun immediately following the 1934 Semi-Annual Meeting and is being continued as a regular part of the Journal program.

Transactions

Transactions of the Society were brought up to date by publication about the middle of February of Volume 32 covering the year 1937. In this volume there were 617 pages. It contained 74 complete papers and discussions.

Volume 32 was sold to members for $2, the charge being entered upon the bill for annual dues.

Roster

The SAE Roster for 1938 contained 15 more pages than the 1937 edition. Names of members on our Reserve Membership List are not included.

The Roster for 1939 will be issued about the middle of February and will be similar in all respects to last year's book.

—STANWOOD W. SPARROW, *Chairman*

Research Committee Report

THE Society's Research activities during 1938 made necessary 75 committee meetings and numerous informal group conferences. Nearly 2000 mimeograph stencils were required to reproduce the minutes and reports. The milestones of progress on several of the projects have been marked by reports presented at the Society's national meetings and published in the SAE Journal[1]; the steps of progress are indicated in this report.

Aircraft-Engine Lubricants

The General Research Committee at its May 1937 meeting agreed to offer some assistance through a committee in improving the chaotic situation relative to aircraft-engine lubricants. During the first months of informal organization the Aircraft-Engine Lubricants Research Committee initiated three projects for the development of:

(1) A method and report forms for the inspection of engines on tear-down after operation in service or full-scale testing

(2) A laboratory method of testing used oil

(3) A method of photographing engine parts

The Aircraft-Engine Lubricants Research Committee, under the chairmanship of C. H.

[1] Effect of Test Conditions on Fuel Rating, SAE JOURNAL, January, 1938, pp. 63-72;

1937 Road Knock Tests, SAE JOURNAL, June, 1938, pp. 244-252;

Correlation of Road and Laboratory Octane Numbers, SAE JOURNAL, October, 1938, pp. 416-420;

Report of Volunteer Group for Compression-Ignition Fuel Research, SAE JOURNAL, January, 1938, pp. 27-36;

Proposed Method of Test for Ignition Quality of Diesel Fuels, SAE JOURNAL, November, 1938, pp. 453-454;

Rating Aviation Fuels in Full-Scale Aircraft Engines, SAE JOURNAL, December, 1938, pp. 497-503;

Investigation of Vapor Lock in Aviation Fuel Systems, presented at the National Aircraft Production Meeting of the Society, Oct. 13-15, 1938;

Riding-Comfort Requirements, presented at the National Passenger Car Meeting of the Society, March 28-30, 1938.

Baxley, was formally organized in 1938. Inspection forms have been developed and given trial use by members of the Committee in engine inspections at the Wright Aeronautical Corp. and Pratt & Whitney Aircraft plants; the necessary information is being secured as a basis for improving the reproducibility of the present test method or developing a new method for determining neutralization number; and, through the cooperation of Dr. V. B. Sease of the DuPont Film Mfg. Corp., progress is being made in the photographing of engine parts.

Crankcase Oil Oiliness

A year ago the definition of the term "oiliness" was adopted and a special subcommittee instructed to proceed with consideration of terminology in connection with wear and seizure measurements. A definition of "wear" has since been developed and "seizure" is being considered.

The results of the first series of comparative wear tests, in which mineral oil and a compound oil of mineral oil and sperm oil were used, were inconclusive, but the Committee agreed to continue its program under substantially more severe test conditions using a mineral oil and a compounded oil made up of the mineral oil plus a compounding agent selected from among the several commercially available (the identity of the compound being concealed). Eleven laboratories are participating in this current test program.

Crankcase Oil Stability

All but 3 of the 15 laboratories participating in the crankcase oil stability tests on oils suitable for automobile use have reported complete data and the results are being analyzed as a basis for a report to the Committee as a whole. The samples are identified by code number only, the majority being commercial oils on which service data are available. Results sufficient to warrant an analysis have not yet been received on the aircraft oils.

Extreme-Pressure Lubricants

The Committee at its May 1937 meeting adopted, as a tentative standard method, a revised procedure for operating the SAE Extreme-Pressure Lubricants Testing Machine, and inaugurated a cooperative program of tests on 3 lubricants to check the performance of the second lot of 10 machines with the first lot of 21. The data submitted indicate that reasonably satisfactory agreement in determining the approximate load-carrying properties of mineral oils and powerful extreme-pressure or hypoid lubricants is obtained with the present SAE machine under the operating conditions outlined in the tentative standard method of test. Whether a revised procedure and machine will satisfactorily rate the milder type of E-P lubricants or not is a matter for further research.

The subcommittee on procedure for wear tests reported fully on the data collected pointing out that these data were of such widely varying types as to make impossible any direct comparison between the data from the various contributors. However, there appeared to be general agreement between the test machines and service testing that the active E-P lubricants result in higher wear rates than the mild type, although the difference seems more pronounced with test machines than in service.

Twenty-two motor-vehicle operators, participating in the study of the stability of extreme-pressure lubricants as regards their tendency to change or break down in service, submitted samples of service lubricants including 14 brands, each brand having been in service in more than one axle and transmission. A preliminary outline of the results obtained in the laboratory testing of these lubricants has been rendered and a more complete report is being formulated.

The latest available operating instructions and test procedures for all testing machines in current use for evaluating extreme-pressure lubricants are being collected with a view to making them available to the members of the Committee and non-member owners of SAE Machines.

Fuels

The Fuels Research Committee, at the request of the General Research Committee, considered the need for a study of the situation with regard to objectionable exhaust gas fumes. A survey indicated that considerable preliminary but fundamental work had been done on this subject, and, through the efforts of the Fuels Research Committee, in cooperation with the interested Activity Committees of the Society, an informal member forum on exhaust gas analysis was held at the Annual Meeting.

Highways

At the beginning of the year, the General Research Committee authorized the Highways Research Committee to undertake, in cooperation with the Highway Research Board of the National Research Council, a project to establish suitable instrumentation for measurement of tractive effort between tires and the road. A survey of available information has been in progress.

The Highways Research Committee, with the approval of the General Research Committee, acted jointly with the Transportation and Maintenance Activity in transmitting to the SAE Standards Committee "Recommended Safety Features Involving Trailer Couplings" with a recommendation that this report be published in the SAE Handbook as a Recommended Practice. In this connection work is being continued toward standardization of king-pin off-set and the design of the king-pin itself.

The Highways Research Committee has continued its cooperation with the American Standards Association submitting technical information as required on the problems involved in motor-vehicle inspection.

Ignition

The proposed specifications for high tension ignition cable for automobile and aircraft use, respectively, were completed during the past year and the specification for automotive type cable has been turned over to the SAE Standards Committee. The specification for aircraft cable has had approval by members of the Committee, cable manufacturers, and airline operators, but minor details of the specification are being clarified prior to its formal approval and transmission to the Standards Committee. The work of the Ignition Research Committee has contributed to the solution of the difficulty of wire burning which is a cooking process due to moisture attack of the cable shielding.

Progress is being made on motor-vehicle spark-plug testing and a report is being formulated.

Riding Comfort

With the cooperation of instrument manufacturers, an exhibit of six instruments was staged at the White Sulphur Springs meeting. A paper giving summary descriptions of the instruments at the exhibit, describing other available instruments, and including a résumé of the more important research instruments was prepared for distribution at the exhibit and circulation to interested persons and organizations.

Cooperative Fuel Research

The work of the Cooperative Fuel Research Committee was the subject of 7 reports to the Society during the past year. The reorganization of these activities, started a year ago, has been completed, and the work is now supervised by the following 5 divisions:

I. Motor Fuels Division
II. Aviation Fuels Division
III. Automotive Diesel Fuels Division
IV. Non-Petroleum Fuels Division
V. Survey Division

During the past year the Motor Fuels Division completed the work of analyzing the 1937 road and laboratory knock test data with a view toward obtaining better correlation. These activities have been completely reported in papers read at the Society's meetings.[1]

The Division in cooperation with the Survey Division and the Automotive Survey Committee of the American Petroleum Institute conducted cooperative road tests during 1938. A procedure for running the tests was worked out and the participants organized into four geographical groups. The data are being tabulated and analyzed at the National Bureau of Standards, and a formal report will shortly be made available.

Sets of laboratory conditions which will give knock ratings similar to those obtained by the Research Method have been studied, and a method which may be used with more facility than the Research Method has been devised and is being given trial use.

The problem of secondary reference fuels suitable for rating tractor fuels is being considered; instrumentation for measuring knock, and altitude and humidity effects are being investigated.

The Aviation Fuels Division has under way projects on full-scale detonation, laboratory detonation, vapor lock, and fuel tank corrosion. The full-scale program in the high octane number bracket is in progress. Limited engine tests have been made particularly in comparing leaded reference fuels with varying lead contents. A means of averaging octane numbers in the region of 100 has been suggested for use in analyzing data which include ratings just below and just above 100. A group has recently been organized to compile and correlate the various suggestions that have been made for extending the octane scale beyond the present 100 octane number limit. Special effort is being directed toward the development of a new laboratory method which will rate fuels equal to certain percentages of the high and low reference fuels, these percentages having been determined as a result of full-scale rating.

The progress on the vapor lock projects was covered in a paper recently presented to the Society.[1] Experimental work is under way on pressure drops and flow through fuel lines in the laboratory test set-up at the National Bureau of Standards.

The Cooperative Fuel Research Committee, at its meeting on May 6, 1938, approved the formation of Fuel Tank Corrosion Projects under the Aviation Fuels Division. The program submitted and adopted at that time included 6 sections dealing with corrosion of tank interiors, and 5 working groups have been organized to carry out the undertaking. Seven factors in preventing or minimizing corrosion have been proposed and the Materials and Fuels Groups have agreed to cooperate in a series of corrosion tests studying the effect of various fuels, both dry and contaminated with water, on the several different materials used for aircraft fuel tanks. The test program is in progress.

The work of the Automotive Diesel Fuels Division and its predecessor, the Volunteer Group for Compression-Ignition Fuel Research, led to general agreement on the following main points:

1. That ignition quality of diesel fuels is best expressed in terms of reference fuels, and that the most suitable reference fuels for this purpose appear to be cetane and alpha methylnaphthalene

2. That the ignition quality of the sample

should be compared with that of the reference fuels on the basis of the ignition delay period

3. That of the available standard testing equipment the most suitable for further trial was the CFR Engine fitted with the high-turbulence diesel cylinder.

A year ago individual laboratories were investigating a variety of instruments for indicating the relative delay period on the CFR Engine. To acquaint the members of the Division with these instruments preparatory to reaching an agreement on the most acceptable one, a demonstration meeting was arranged at the Shell Laboratories. The meeting was attended by 22 representatives from 15 laboratories, and, as a result of two full days of cooperative testing, the group selected an instrument and method which were considered a very definite improvement over past methods. This method, under the title: "Proposed Method of Test for Ignition Quality of Diesel Fuels," has been approved by the Cooperative Fuel Research Committee for publication "for information" by the American Society for Testing Materials and in the trade press.[1] An exchange group has organized a program of reproducibility tests carried out in a similar manner to those of the Motor Fuels Division.

The Non-Petroleum Fuels Division has had no active projects during the past year.

The survey work of the Cooperative Fuel Research Committee has been reorganized under one division which supervises the three survey projects, namely, aviation fuels survey, motor fuels survey, and motor survey.

The groups working on Aviation Fuels Survey Projects in the current program concentrated on a reduction in the number of aviation fuel specifications. As a result of cooperative efforts of representatives of aircraft engine manufacturers, airline operators, and aviation fuel producers, specifications for five octane number grades of aviation fuel were submitted by the Cooperative Fuel Research Committee to the Air Transport Association of America. These specifications for domestic commercial use, which provide for five grades of fuel of octane number designations 73, 80, 87, 90, and 95 octane number, respectively, with a single specification for all of the fuel criteria, except lead content, were in turn approved by the Air Transport Association of America and transmitted to the International Air Transport Association.

The Committee has continued its cooperative agreement with the National Bureau of Mines whereby the Bureau completes the analysis of data collected by the Committee in a national motor gasoline survey, and issues a semi-annual report covering the winter and summer gasolines sold throughout the Country. The Committee is endeavoring to collect, through its petroleum membership, similar data on fuels marketed abroad. This information will be supplied for the confidential use of automotive manufacturers only, and coverage will be limited to the principal export markets.

The groups working on Motor Survey Projects have cooperated with the Motor Fuels Division and the Automotive Survey Committee of the American Petroleum Institute in carrying out the 1938 cooperative road tests described earlier in this report.

—G. W. Lewis, *Chairman*

Sections Committee Report

AMONG the high-spots in Section activities for the calendar year 1938, three deserve special mention. They are:

1. The excellent meeting programs arranged by the Sections.

Nearly every Section planned an entire season's schedule of meetings well in advance, which made it possible for them to secure outstanding speakers on up-to-the-minute topics.

2. The very noticeable improvement in the type of monthly meeting announcements.

Each Section meeting was attractively presented to the Section members by means of well-arranged facts regarding the speaker, his subject and other interesting information concerning the event.

3. Increased Section meeting attendance.

The two foregoing "high-spots" undoubtedly had much to do with the increase in meeting attendance experienced by practically all of the Sections. Approximately 25,000 members and guests attended Section meetings during 1938, an increase of 14% over 1937.

The following survey shows the topics discussed before the 22 Sections during the year:

Subject	No. of Papers
Aeronautics	50
Passenger Cars	37
Transportation and Maintenance	30
*General	30
Fuels and Lubricants	22
Parts and Equipment	18
Trucks, Buses and Railcars	13
Social Meetings	13
Engines	12
Diesel Engines	9
Tractor and Industrial Power Equipment	8
Traffic and Safety	7
Bodies	5
Metallurgy	5
Production	3
Research	2
Plastics	2
Air Conditioning	1
Racing Cars	1

Membership and Other Committee Work

All Sections paid particular attention to their Committee personnel, so that each Governing Board contained the best talent in the Section for the various Committee posts. Meetings Committee, Reception Committee, Placement and Student Committee Chairmen were chosen from among members particularly qualified for the work, and special attention was given to the choice of Membership Committee Chairmen.

The Section Membership Committees have done exceptional work in cooperating with the General Membership Committee. Section members are to be commended for the many personal contacts made among eligible prospects in their territories, which have resulted in the receipt of signed applications.

Section Cooperation in National Meetings

The Chicago, Detroit, Metropolitan, Milwaukee, Southern California and Washington Sections participated most effectively in National Meetings held in their Sections, and rendered invaluable assistance in the preparation of the programs and in the general conduct of the meetings.

The Tulsa Group

The Tulsa Group, operating informally, staged some very interesting meetings during 1938. They have a progressive organization, the aim of which is to increase membership in the territory sufficiently to warrant application for Section standing. This group did some excellent work in connection with the National Fuels and Lubricants Meeting of the Society held in Tulsa in October.

The SAE Club of Colorado

The Colorado Club has been carrying on effectively, holding meetings periodically, and in general keeping the SAE spirit alive in the territory.

*The General Meetings were on such topics as Factors Influencing Engineering Organization, the Economic Outlook, Color Research, National Defense, Educating the Engineer, and the like.

Student Activities

With the addition of an SAE Student Branch at the University of Michigan, the Society now has 10 Student Branches located as follows: University of Alabama, General Motors Institute, Massachusetts Institute of Technology, New York University, University of Detroit, Oregon State College, Purdue University, Ohio State University, University of Michigan, and University of Oklahoma. Each of these Branches was well organized in the way of officer and committee personnel, and held instructive and interesting meetings. Student enrollment in the Society has increased approximately 30% over the same period last year.

Section Visits

During 1938, each Section of the Society was visited at least once by a member of the SAE staff. President Spicer addressed 11 Sections during the year.

* * * *

There has been definite progress in all Sections during 1938, which can be attributed to the splendid work of the fine group of men elected as Section officers. They are commended for their interest and their leadership.

—F. K. Glynn, *Chairman*

Standards Committee Report

WITH the election of the Society's administrative officers for 1938, C. W. Spicer, Chairman of the 1937 Standards Committee, became President of the Society and appointed John H. Hunt as Chairman of the 1938 Standards Committee. The organization and personnel of the Committee are otherwise substantially as they were last year except for the appointment of some new members. The policy has been continued of selecting the most effective personnel for this work and of keeping the main Divisions as small as possible consistent with best results.

SAE Standards Committee

The Committee's activities during the year consisted largely of reviewing a number of the present standards to bring them up to date, and approving several proposed American Standards submitted to the Society as a sponsor for them under American Standards Association procedure. Most of the work was of such a nature that it was handled largely by correspondence rather than by holding meetings.

In the main, the Committee's activities were devoted to subjects of major importance to the industry as a whole. A considerable amount of the work involved cooperation with other groups such as the Radio Manufacturers Association in studying ignition interference with short wave radio and, more recently, television broadcasting. A joint Committee was designated by invitation of the American Society of Refrigerating Engineers to formulate standard methods of rating and standard tests for air conditioning of buses and refrigerating of trucks. New specifications for motor-vehicle suspension springs were developed with the cooperation of the American Association of Steel Manufacturers Technical Committee to meet the latest practices in spring design.

The principal activities in the Standards Committee itself included a review of a large part of the non-ferrous metal specifications and the heat treatments for SAE steels. In the field of automotive accessory equipment, the specifications for various types of illuminating and signalling lamps were revised; several standards pertaining to aircraft engines were reviewed; the entire line of ball and roller bearings was modernized and the fuel and oil line fittings were modified in several details. A new standard for rating speedometers and their allowable error in readings was worked out and an important new standard for involute splines of 6, 10,

16, 24 and 36 teeth for shaft diameters from 0.7876 to 4.3311 in. inclusive was adopted. This standard includes detail dimensions for both the shaft and the fitting, method of measurement and dimensions for the hobs. This new specification will be included eventually as part of the present SAE Standard for straight side splines.

American Standards Association

The Society has continued its active participation in the work of many of the Sectional Committees under the American Standards Association, both those for which it is a sponsor and those on which it is otherwise represented. It is also functioning actively as a member body of the ASA through its representation on the ASA Standards Council, the Mechanical Standards Committee, the Committee on Highway Safety Standards and others of broad technical and advisory importance.

International Activities

During the year the Society was represented by delegates at meetings in Berlin of the ISA Committees on Automobiles and Aircraft. The membership of these Committees is international and their work is under the jurisdiction of the International Standards Association which is a federation of the national standardizing bodies in various countries such as the American Standards Association in America. Its function is to encourage international cooperation and agreement on standards but not to formulate international standards as such.

SAE Handbook

A new 1939 edition of the SAE Handbook to include revisions that have been adopted on current standards and new standards adopted during the year will be issued probably in the early spring. As usual a large number of the 1938 Handbooks were distributed here and abroad aside from those regularly sent to the members of the Society. Following usual custom, copies were also sent to libraries of many other technical bodies, universities, government departments and bureaus and to general libraries. The 1938 edition was also sent to the motor-vehicle administrative officials in every state and to their national association. A copy of the Handbook was also sent to the secretary of the national standardizing body in each of the countries abroad that are included in international standardization activities under the ISA and with which the Society has maintained direct communications.

General

The Society's activities in standardization work both within its own organization and in cooperation with other technical bodies have continued to move forward although perhaps in some instances more slowly and in new channels. Your Standards Department has also during the year corresponded with many of the countries abroad including British dominions such as Australia, New Zealand, South Africa and several of the South American republics relative to standards and their use.

Evolutionary changes taking place in industry and in many instances new conditions and requirements imposed upon it make the use of economic engineering instrumentalities such as SAE Standards, more necessary than ever before. Standards, when properly developed through the industry's own machinery as provided by the Society, should not be overlooked by industry's managements in deciding their programs that will be the basis of the work to be done by their engineering and manufacturing departments. The Society's committees for formulating these standards are in the last analysis major tools of industry that should be recognized and supported to the greatest possible extent.

—JOHN H. HUNT, *Chairman*

Treasurer's Report

FOR the fiscal year ending Sept. 30, 1938, the following figures give a brief summary of the Society's finances:

	Actual	Budgeted
Total Income	$246,827.07	$270,000.00
Total Expenses	248,448.03	261,335.00

This shows that operating expenses exceeded income by $1620.96, whereas the budget anticipated an unexpended income of $8665. Income experienced a decrease of 9% below estimates for the year due primarily to decreases in advertising revenues, which were approximately $30,000 under the budget estimate. Revenue from dues and initiation fees showed a substantial increase over the previous fiscal year. Expenses were kept 5% below estimates during the same period without materially reducing the direct service benefits to members.

The comparative balance sheet and income and expense statements which are a part of this report show in detail the Society's finances as of Sept. 30, 1938.

During the past fiscal year the investment portfolio of the Society was increased by $12,547.01, its total book value at the close of the fiscal year being $220,154.77. The actual market value of these securities on the same date was $212,873.13.

As is customary each year, the books of account have been audited by Haskins and Sells.

—DAVID BEECROFT, *Treasurer*

BALANCE SHEET AS OF SEPT. 30, 1938

Assets	
Cash	$ 20,674.68
Accounts Receivable	1,591.36
Securities	*220,154.77
Accrued Interest on Securities	2,608.93
Inventories	768.85
Furniture and Fixtures	1,000.00
Items Paid in Advance, Charges Deferred	10,173.45
TOTAL ASSETS	$256,972.04
Liabilities and Reserves	
Accounts Payable	$ 3,537.39
National Dues and Miscellaneous Items Received in Advance	11,397.72
Reserves Set Aside for Anticipated Expenses	9,688.99
General Reserve	233,968.90
Net Unexpended Income	†1,620.96
TOTAL LIABILITIES AND RESERVES	$256,972.04

*Book Value (Market Value Sept. 30, 1938—$212,873.13).
† Deficit.

INCOME AND EXPENSE AND BUDGET COMPARISON TWELVE MONTHS, ENDING SEPT. 30, 1938

Income	Oct. 1, 1937, to Sept. 30, 1938	Budget
Dues and Subscriptions	$ 83,281.28	$ 82,000.00
Initiation Fees	14,732.50	12,000.00
Interest and Discount	7,987.66	7,500.00
Affiliated Appropriations	18,281.25	20,000.00
Advertising – Journal	91,035.00	120,000.00
Advertising – Handbook	4,825.00	6,500.00
Miscellaneous Sales	24,579.82	22,000.00
Profit on Sale of Securities	414.83	.....
Unused Portion of Section Dues	1,689.73	.....
TOTAL INCOME	$246,827.07	$270,000.00
Expenses		
Research	$ 15,145.45	$ 14,790.00
Standards	7,972.76	8,525.00
Publications	49,929.23	50,670.00
Sections	7,660.28	9,080.00
Regional Meetings	1,584.89	2,000.00
Meetings	17,515.59	23,790.00
Institutional Promotion	1,509.87	2,500.00
Professional Activities	368.64	400.00
Membership Increase	12,383.67	12,075.00
Advertising – Journal	30,824.13	33,675.00
Advertising – Handbook	926.16	1,300.00
Miscellaneous Sales	10,020.99	10,310.00
General Expense	80,812.06	81,150.00
Engineering Relations	11,794.31	11,070.00
TOTAL EXPENSE	$248,448.03	$261,335.00
Net Unexpended Income	$1,620.96†	$8,665.00

† Deficit.

News of the Society

(*Continued from page 40*)

cost of handling. Dr. Barnard admitted a 4% saving in using higher distillate range fuel as compared to the regular passenger-type fuel as now generally available either in tank wagon or service station.

Personnel Management Seen as New Science

● Northwest

It may be that industry's discovery of the importance of the problems of personnel and its willingness to analyze them and meet them fairly is evidence of the development of a new science, N. J. Aiken, associate professor of economics and director of placement, State College of Washington, told 60 members and guests of the Northwest Section, Dec. 9.

In his paper, "A New Emphasis in Industrial Management," Prof. Aiken analyzed the characteristics of working people and the characteristics of our highly technical, complex, modern industry. He pointed out that modern industry, with its division of labor, its complexity, and its revolutionary change, has been pretty hard on the instinctive characteristics of working groups, and conflicts have arisen.

Continuing, he said, "The problem of humanics – the problem of human engineering – or the problem of the application of psychology is to mitigate that conflict." He advocates that management should handle the problem with the same open-mindedness, frankness, and scientific procedures that the engineer uses in meeting his.

Foregoing a technical meeting for the month of January, the Northwest Section entertained Jan. 14 with a dance and buffet supper at the New Washington Hotel in Seattle. Approximately 50 couples attended.

Questions Trend Toward 6 & 8-Cyl. Tractors

● Tulsa Group

Interesting points of view on trends in agricultural tractors were presented to the Tulsa Group by Arthur Dilts, instructor in farm machinery at Oklahoma A. & M. College, at the Group's Dec. 16 meeting.

"Is it good sense," Mr. Dilts asked, "to build farm tractors with six and even eight cylinders? We know," he continued, "that multi-cylinder engines give us speed flexibility and high horsepower per weight, and neither of these are necessary nor desirable in a tractor."

On the subject of fuel, he said that we are "climbing the stairs" from dieselene to distillate to kerosene to gasoline to butane-propane. Possibly we should come down, he continued, adding that it is all in the point of view. Speaking further on butane-propane, he said that the distributor must not only sell and distribute the fuel but must educate the user; actually help him convert his tractor for butane and stay with him and help him burn it.

Equipping a tractor for butane, he said, is an engineering accomplishment. Compression ratios should be stepped up and compression pressures of from 130-145 lb per sq in. used to burn butane-propane to best advantage, Mr. Dilts explained, adding that the butane must be kept under considerable pressure, released to the carburetor through a pressure regulator, and a heat exchanger must be installed where the liquid gasifies on the liberation of pressure. There should be a good market for this by-product fuel which is said to be a drug on the market, he stated.

Turning to tires, the speaker declared that air tires limit the pulling ability of tractors. An air-tired tractor, he continued, will pull about half of its weight while a steel-wheeled tractor almost pulls its weight. He told of one weighing 5307 lb which made a pull of 4555. In order to pull and wear air tires on tractors must be weighted, he added.

Before closing the speaker maintained that integral machinery mounted on a farm tractor is much superior to any machine pulled behind a tractor. Unfortunately, he added, this equipment is very expensive and is not interchangeable to any other than the tractor for which it is designed. Speaking further on this subject he said that the farmer purchasing a $495 tractor may find that he has to buy a whole line of integral machines before he can use the tractor. By the time he is ready to put the tractor to work, Mr. Dilts said, the farmer finds that he has spent about $2,000 for equipment to farm only the smallest farm; and that all of this equipment will be of no value to him when he trades his tractor in on a new one.

Contributing to the discussion of Mr. Dilts' paper were: R. D. Best, Continental Oil Co.; W. L. Thompson, Mid-Continent Petroleum Corp.; Gene Heins, Hydraulic Power Co.; and O. L. Garretson, Phillips Petroleum Co.

SAE Establishes Oil Temperature Ranges

There has, in the past, been considerable disagreement between automobile manufacturers individually, between oil companies individually, and between both industries collectively as to the temperature ranges in which oils of different SAE motor oil classification should be employed. At the request of both industries, the lubricants division of the SAE Standards Committee has given this question extensive consideration and has reached the conclusion that there are the following temperature ranges for which motor oils of different viscosities are liable to be needed:

1. When the lowest expected temperature is less than —10 F
2. When the lowest expected temperature is —10 F
3. When the lowest expected temperature is +10 F
4. When the lowest expected temperature is +32 F
5. When the expected daytime temperature is 90 F or over.

These ranges correspond to very cold winter weather, normal winter weather, normal summer weather, and very hot weather. It must not be supposed, it is stated, that standardizing these four temperature ranges in any way suggests that four different oil viscosities are necessary to take care of all conditions for all equipment. This depends upon the design and construction of the engines, and also to some extent upon the nature of the oils employed. The basis, according to the lubricants division, is the axiom that in relatively cold weather an oil characteristic of primary importance is its viscosity at starting temperatures, whereas in hot weather the viscosity of greatest importance is that at relatively high temperature, because it is this quality which influences oil consumption. Practically speaking, it is obvious that with this temperature set-up, two viscosities of oils will take care of most engines in any particular territory. In parts of the South the normal seasonal ranges would be for a minimum of 32 F and for a daytime maximum of over 90 F; whereas in territories where —10 F is a normal winter anticipation, temperatures over 90 F are most uncommon; whereas the two middle ranges cover the larger part of this country, it is noted.

Practically all automobile manufacturers are now using these ranges in their instruction books, and the same is true of a majority of the oil companies. It is believed that this SAE action will be very helpful to the average driver who usually depends upon the recommendation of some oil company's service station as to what he should use at that particular time of the year.

Test Favors 1000-Mile Oil-Change Periods

● Baltimore

After listening to oil salesmen talk about viscosity, V.I., pour, flash, fire, color, sludge, paraffinicity, naphthenicity, solvent and acid treat, corrosion, wear, detergency, ring sticking, piston sticking, and so on, private and fleet operators become so confused over a period of time that they decide to use the oil which has been reasonably satisfactory in the past or to switch to another brand for trial purpose, F. C. Burk, supervisor, automotive laboratory, Atlantic Refining Co., told 60 members and guests attending the Jan. 5 meeting of the Baltimore Section. Therefore, he added, any information which will assist the operator in selecting the kind of oil best suited for his purpose is of real value.

With this in mind the author told of tests made by his company on ninety 1933 and 1934 3-ton model UD Autocar trucks. After explaining the method of test he listed the following conclusions:

1. Naphthenic type oils are more undesirable than oils of paraffinic type.
2. Crankcase oil-change periods on a semi-annual basis are more undesirable than those on a 1000-mile basis.
3. Fuel oil delivery service is more severe than gasoline delivery service.
4. Heavier oils, higher SAE numbers, cause more cylinder wear but reduce oil consumption.
5. Paraffinic oils are comparable with straight Pennsylvania oils.
6. The cost of changing oils at 1000-mile intervals is greater than at 3000-mile intervals, but saving in engine wear favors the 1000-mile oil change period.
7. Oil change periods of 5000 miles are too high.
8. Oil filters, when used according to a manufacturer's recommendations, do not maintain the crankcase oil in better condition than if the filters are not used. This does not mean that the principle of using a filter is basically wrong, but that the maintenance of the filter element as recommended may be too infrequent, he explained.

"The above conclusions," Mr. Burk stated, "are purposely of a very broad nature as it is very easy for one to apply them to all types of operating equipment. It may be true that they can be applied to other types of operation, but our data will only support these tests."

He goes on to say that considerable time and money were consumed in obtaining and summarizing these results and he doubts that a fleet owner would be justified in making tests of a similar nature. Therefore, he says, the best course is probably that which most fleet owners now follow: namely, using a quality product manufactured by a reliable refiner and following the refiner's recommendations.

Barriers to Safety Regulations Named

● No. California

Until those who understand the problems involved in traffic regulation can have more voice in the establishment of new regulations, ideas for reducing traffic hazards such as selectively rating drivers' abilities or removing unsafe vehicles from the highways, will be impossible. This was the impression of members of the Northern California Section after hearing "Federal and State Regulations of Motor Vehicles" discussed at their Jan. 10 meeting by three men who have much to do with motor carriers in California.

Russell Bevins, district supervisor of the Interstate Commerce Commission, reviewed the results of a survey made by that commission which showed that in the 13 far western States there was no uniformity in the regulations gov-

erning motor carriers. As an example he cited night clearance lights on trucks. The survey showed that no less than a half-dozen different colors or combinations of colors were in use. The commission therefore sponsored a test program measuring the visibility of various colored lights and found that amber is the most effective.

This Commission was reported likewise interested in the standardization of: 1. Brake specifications; 2. Drivers' ability tests; 3. Parts or accessories, such as spot lights; 4. Inspection and maintenance; and 5. Weights and dimensions.

W. R. Sharkey, supervising inspector of the Bureau of Safety of the State of California Highway Patrol, presented some of the safety provisions of the California Safety Code and showed how difficult it is to keep the State Code up to date due to "legislative inaction." He stated, however, that light inspection and the use of safety flares for trucks disabled on the highway recently have been added to the Code to increase safety for motor travel.

Chief E. Raymond Cato, California Highway Patrol, presented some of the problems of regulation. He stated that there are two problems involved: first, the selection and training of man power for enforcement, and second, the most difficult, the training of the general public. His organization is favoring the training of the public by starting with the grade-school students.

It is also the duty of this organization, he reported, to watch the "crackpot" legislative bills which are continually submitted.

Chief Cato stated that the immediate aims in this State for reducing the fatal accident are: 1. Rigid limitation of speed during night driving; 2. Allow speed during day driving according to traffic and road conditions; 3. Increase the allowable cruising speed for trucks; and 4. Inaugurate more stringent regulations governing the braking ability of trucks.

Declares Truck Operating Problems Pace Designers

● Oregon

That truck and equipment manufacturers are experiencing difficulty in keeping pace with problems encountered by truck operators in making equipment stand up against the rigors of different sections of the country, was one of the conclusions to be drawn from the paper presented by J. L. S. Snead, Jr., before the Oregon Section, Jan. 13.

Mr. Snead, who is equipment engineer with Consolidated Freight Lines, Inc., one of the largest motor freight operations in the country, spoke on "Truck Maintenance Problems;" sharing the program with T. C. Howe, superintendent of equipment, North Coast Transportation Co. Mr. Howe presented the same paper he read before the SAE West Coast Transportation & Maintenance Meeting last November, entitled, "Bus Maintenance Problems and Practices." A short sound motion picture of a tour through the Ford River Rouge plant concluded the program.

Some of the rigorous conditions met by trucks in his fleet, Mr. Snead stated, are grueling mountain grades, extreme cold, and extreme heat. His company, he continued, has had to rely on its own engineers and shop mechanics to design and build parts to meet each exigency. Mr. Snead reported several instances where his department had effected advance designs which were passed along to original builders and which resulted in such parts being corrected accordingly.

Mr. Snead said that his company has 117 trucks in service which have run a total of over 36,000,000 miles. At present, Consolidated is "adding over 800,000 miles per month to its experience," he declared. Ten engines already have run in excess of 500,000 miles each, and many others have run well over 400,000 miles, he noted, adding that most of the road equipment is powered with Cummins Diesel engines.

Mr. Howe's paper treated the various inspections maintained by his company, and was illustrated by slides. The latter were devoted almost entirely to a presentation of inspection forms and records kept on all types of equipment.

Fred Dundee, vice-chairman of the Section, acted as chairman of the meeting in the absence of Chairman J. Verne Savage, who was attending the Annual Meeting at Detroit.

Diesel Applications in America and Europe Shown

● New England

The growing use of the diesel engine in America and Europe was shown by O. D. Treiber in his presentation before the New England Section's Jan. 10 meeting. The speaker, who is chief engineer of the Hercules Motors Corp., was introduced by Section Chairman John W. Lane, who presided. Attendance broke previous records of the season.

Mr. Treiber utilized slides to show the numerous uses to which diesel engines are put. These engines, he said, are more costly than gasoline engines to purchase, and will be until they are manufactured in mass-production lots. The higher original cost is, in most instances, more than offset by economical operation, he declared, and supported this contention with statistical evidence.

Noise, one of the prime objections to the diesel, has been overcome to a considerable degree, he said.

About Authors

(*Concluded from page 11*)

Pennsylvania and the New York Central railroads. He then joined the War Department where he has remained since that time developing and testing aircraft materials and fabricating processes in the engineering and inspection departments. He is now chief of the Material Branch at Wright Field. Mr. Johnson has written several papers dealing with materials and is author of a book on aircraft welding.

● **A. H. Leak** ***(M '32) was born in England and educated at Yarmouth College and Gt. Yarmouth Technical School. After obtaining shop and test experience with William Burrell, marine engineer, Mr. Leak did drafting and design work with English concerns manufacturing marine engines, motorcycles, light cars and both liquid and air-cooled aircraft engines. In 1923 he was engaged by the Curtiss Aeroplane & Motor Co., and from drafting and design work was later appointed assistant chief engineer. Since 1931 he has been associated with the Wright Aeronautical Corp., first as project engineer and subsequently as design engineer.***

● **B. A. Yates** ***is chief metallurgist of McQuay-Norris Mfg. Co. Ten years ago, in 1929, he was graduated from the University of Cincinnati after completing its cooperative five-year plan in chemical engineering. The next several years were spent with the National Cash Register Co. in its brass foundry. Later he had several years' experience in the laboratory of the Dayton Malleable Iron Co., before joining McQuay-Norris as chemist. From chemical and analytical work, Mr. Yates was progressively placed in charge of all metal working units, including heat treating, foundry operations, both cupola and electric furnace, and white metallurgy. He also is in charge of all plating work, such as anodizing, chrome, copper and tin plating.***

Applications Received

(*Concluded from page 42*)

Northern California Section

BLOISE, GEORGE P., Consolidated Freight Lines, San Francisco.

BRITTEN, CLYDE H., assistant manager, T. A. Department, Shell Oil Co., San Francisco.

CELLI, BEN, JR., sales manager, Cochran & Celli, Oakland, Calif.

MILLER, CHARLES D., assistant superintendent of equipment, Market Street Railway, San Francisco.

Philadelphia Section

THERMOID CO., Trenton, N. J.

Pittsburgh Section

SERGESON, ROBERT, chief metallurgist, Crucible Steel Co. of America, Pittsburgh.

WELKER, R. M., auto. lubrication engineer, Gulf Oil Corp., Pittsburgh.

St. Louis Section

BAGGERMAN, FREDERICK P., junior engineer, Shell Petroleum Corp., Wood River, Ill.

EWART, WILLIAM M., factory manager, Carter Carburetor Corp., St. Louis.

GRIFFITH, LEROY W., junior research engineer, Shell Petroleum Corp., Wood River, Ill.

ROTTER, LUTWIN C., chief engineer, Lincoln Engineering Co., St. Louis.

VON BEHREN, EDWARD E., mechanical expert, Bendix-Westinghouse Air Brake Co., St. Louis.

Southern California Section

CLARK, OLIN B., service engineer, Airsupply Co., Los Angeles.

MUNDHENK, ROBERT A., weight engineer, Lockheed Aircraft Corp., Burbank, Calif.

Southern New England Section

HESS, DONALD P., president, American Bosch Corp., Springfield, Mass.

Outside of Section Territory

DORLAND, HARLAN NEWTON, service school instructor, Ford Motor Co., Oklahoma City, Okla.

EVANS, DAVID T., manager, lubrication department, Globe Oil & Refining Co., Wichita, Kan.

GEFFS, ROBERT CHASE, general manager, Brebner-Sinz Machinery Co., Green Bay, Wis.

GERNER, HUGH, JR., superintendent of maintenance, Yellow Transit Co., Oklahoma City, Okla.

GOLDSBERRY, A., ER Prestone Specialist, National Carbon Co., Inc., Dallas, Tex.

WRIGHT, BEN, owner, American Electric-Ignition Co., Oklahoma City, Okla.

Foreign

ROBBINS, BRIAN GORDON, secretary, The Institution of Automobile Engineers, London, England.

ROSS, COLIN GEORGE, JR., lecturer, Pretoria Technical College, Johannesburg, Transvaal, South Africa.

SCHMIDT, FRITZ, technical director, Daimler-Benz A.G., Stuttgart, Germany.

SPRINGFIELD, J. B., Pratt & Whitney Aircraft Corp., Germiston, Transvaal, South Africa.

TATLOW, HERBERT E., technical and sales representative, Samuel Fox & Co., Ltd., Stocksbridge, Sheffield, England.

THOMAS, WILLIAM MILES WEBSTER, managing director, Wolseley Motors, Ltd., Birmingham, England.

SAE Papers in Digest

HERE are digests of papers presented at various meetings of the Society.

Some of these papers will be printed in full in the SAE JOURNAL.

Mimeographed copies of *all papers received* will be available, until current supplies are exhausted, at a cost of 25 cents per copy to members; and at 50 cents per copy to non-members, plus 2% sales tax on those delivered in New York City. Orders for mimeographed copies must be accompanied by remittance and should be addressed to Sessions Secretary, Society of Automotive Engineers, 29 West 39th St., New York.

T. & M. Public Utility Meeting Cleveland, Ohio April 28-29, 1938

Public Utility Bodies and Associated Equipment – *P. E. Hawkins, Baker-Raulang Co.*

THIS paper touches upon the progressive improvements made in utility bodies and associated equipment as aids in mechanization for utility construction and maintenance work. Various topics for discussion are advanced, looking toward time-saving, lower operating costs, improved efficiency, and greater safety and comfort for operating crews.

Types of bodies now used are reviewed, and the advantages of standardization of designs mentioned.

Improved design features include all-metal bodies, crew-carrying facilities, water-tight compartments, doors, arrangements for carrying pikes and ladders, telescoping metal three-section roof, and so on.

The section devoted to load distribution on front and rear tires suggests the importance of proper distribution in terms of steering, traction and tire wear, and the tendencies found in practice for both standard and C.O.E. types of chassis.

Automotive steel, alloy steels, and aluminum are discussed from the standpoints of initial cost, lightness and paint upkeep, with oven-baked enamel suggested as the best finish.

The conclusion of the paper relates to future designs, improvements including a new monotype body and some equipment features.

Present and Future Trends in Public Utility Equipment – *N. P. Larsen, American Coach & Body Co.*

STANDARDIZATION of bodies and associated equipment for trucks is fast becoming an accomplished fact, and is naturally creating further study and development on the part of the manufacturer. Decided improvements and simplification of construction, together with elimination of excess weight, have been made. Further efforts in this direction are still being made, with the result that vehicles of lower-gross-weight capacity are now in general use with a proportionate reduction in cost of the unit.

Truck units carrying crews varying from five to seven or more men are now being equipped with bodies in which a crew compartment is provided as an integral part. This design tends to do away with the separate cab and body commonly used in the past; reduces the weight; slightly increases the usable body space; and reduces the cost.

Telescoping the crew compartment between the material bins on line-construction units materially shortens the vehicle; provides better maneuverability; and gives a shorter turning radius, which is quite important for this type of unit.

New designs ready for introduction are shown, one of which is a line-construction unit using a cab-over-engine chassis. In addition to this arrangement, a new winch with vacuum-operated clutch is incorporated, doing away with the control-lever problem.

A service body with flexible partition and shelf arrangement adaptable to five or more distinct services, and with an improved method for carrying electric meters of various types, is described.

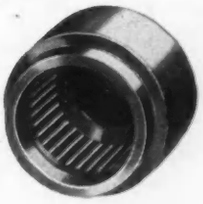
Selection of Truck Chassis for Public Utility Use – *J. R. North, Commonwealth & Southern Corp.*

THE operating requirements of engine-driven vehicles in public-utility service are outlined in this paper, and the important considerations involved in the selection of suitable chassis for various types of service are described. The application procedure described has, during the past several years, resulted in savings of many thousands of dollars to one large group of utility companies in the purchase of equipment and in subsequent operating costs.

The use of trucks in the construction, operation, and maintenance of public-utility systems is vastly different from their use in normal highway transport service. For example:

1. The annual mileages are very low.

THE Accepted Spicer UNIVERSAL JOINT



Needle bearing assembly

Exclusive licensees under Goetz U.S. Patent RE 18080

● The 1939 Spicer "Needle Bearing" universal joint has the traditional high load capacity, low friction, low operating temperatures and high efficiency in which Spicer joints have been outstanding.

The proved design insures satisfactory performance. The importance of RELIABILITY is recognized by engineers of leading automotive manufacturers who specify the Spicer universal joint.

Spicer Manufacturing Corporation • Toledo, Ohio

BROWN-LIPE CLUTCHES and TRANSMISSIONS | SALISBURY FRONT and REAR AXLES | SPICER UNIVERSAL JOINTS | PARISH FRAMES READING, PA.

2. The load-weight factor is poor.

3. Space must be provided for carrying large crews.

4. The cost of special bodies and equipment relative to chassis cost is very high.

5. Operation off the highways is quite usual with certain types of units.

6. The engine must be suitable for long periods of operation at standstill when driving auxiliaries.

The factors which need to be evaluated in selecting a truck chassis for specific classes of work are discussed, including:

1. Strength with respect to load-carrying ability.
2. Power or ability to move loads.
3. Allowable road speed.
4. Overall chassis and engine characteristics.
5. Economic considerations.

Formulas are given for calculating the various performance rating factors, and a comparison is made of typical current models.

It is concluded that the selection of a truck chassis warrants careful consideration of the requirements for each class of service and analyses of the various characteristics of the vehicles available. This should include:

1. Transportation job analyses.
2. Comparison of suitable chassis.
3. Comparative costs.
4. Purchase specifications.

It is also concluded that present-day equipment, because of improvements in the design and performance of motor vehicles, may be considerably lighter and less costly than equipment purchased but a few years ago. The depreciation and operating cost of these lighter units would be correspondingly less.

Engineering Memo
DEPENDABLE Dole THERMOSTATS
The Dole Line of Automotive Thermostats includes models for motor block and hose line installation . . . both Poppet and Butterfly Types . . . with and without nipples for hot water heater connection. All models assure reliable automatic control of engine temperature under varying road, load and weather conditions . . . are proof against leak, seepage and wear.
DEPENDABLE THERMOSTATIC BI-METAL
Dole Thermostatic Bi-Metal . . . made to exacting specifications by time-tried procedures that assure complete uniformity of quality . . . can be purchased in (1) Sheets up to 14 inches wide; (2) Strips any width; (3) Coils, as long as 1,000 feet; (4) in diversified fabricated parts such as spiral or helical coils, hairpin or U-shapes, flat strips, etc.
DEPENDABLE Dole FITTINGS and Special Parts
Compression couplings for all tubing connections and a complete assortment of water line and hose parts for automobile hot water heaters . . . all built and factory tested to withstand severe vibration and strain. Also special brass parts from customer's blueprints . . . to his specifications.
THE DOLE VALVE COMPANY
1901-1941 CARROLL AVENUE CHICAGO, ILLINOIS
DETROIT OFFICE: 2-137 GENERAL MOTORS BLDG.
DOLE

Why Continue to Use High-Pressure Truck Tires? – *J. E. Hale, Firestone Tire and Rubber Co.*

HAVING been the subject of intensive development by the tire manufacturers for several years, the balloon truck tire is now equal or better in every way to the high-pressure type. The truck balloon and truck high-pressure lines each comprise a full range of sizes covering the same scope of tire ratings as to load capacity and general suitability for trucking service. The tire manufacturers feel that to continue both balloon and high-pressure truck tires is needless duplication. Therefore, this paper has for its purpose to encourage the use of the balloon tire and to discourage further demand for the high-pressure tire.

In the considerable data presented, high-pressure and balloon tires are compared technically and practically. Other sections of the paper are devoted to the benefits of low-pressure truck operation; an explanation of why balloon tires will give longer mileage with less premature failure than high-pressure tires; and suggestions on how the truck manufacturers can be helpful in discontinuing the high-pressure tire. A supplementary section covers the question of mud and snow tires versus conventional tires with chains.

Engine Deposits – Causes and Effects – *Fred Heinlein, Cincinnati Gas & Electric Co.*

COLLECTION of foreign material in engines may be expected in a number of locations such as combustion-chamber, under piston surfaces, piston-rings and grooves, valve stems, and crankcase.

The influences governing these deposits may be classified as follows:

(1) Factors depending on the present condition of the engine, such as fit of the piston, rings, and the time of operation since cleaning.

(2) Those dependent on the circumstances of operation, principally, temperature, speed, load, and air-fuel mixture ratio.

(3) Those dependent on the material supplies – fuel and lubricating oil.

The part which fuel can play in contributing to combustion-chamber deposits consists of a gum and lead deposit. The causes and effects of carbon deposits in combustion-chambers are discussed. The deposits of under piston surfaces can be traced entirely to lubricating oils. Causes and effects of fouling, clogging, and sticking of piston-rings; of low-temperature operations; of fleet service; of idling of motors; of starting and stopping; of dilution; of rich mixture; and of blowby, are considered. .

Crankcase deposits, low-temperature operations in winter weather, and formation of sludge, which should be designated as emulsion, are dealt with. High-temperature operations under heavy load produce insoluble substances.

Higher temperature thermostats, winter fronts, and better oil filters were installed to prevent emulsion.

Curves and figures are presented showing the condition of the oil at various mileage periods with the use of an oil filter and also the results of a laboratory test of an oil sample without filter.

The Importance of Periodic Engine Tune-Up – *E. J. Gay, Ethyl Gasoline Corp.*

PRACTICAL reduction in engine fuel costs cannot be accomplished by the waving of a magic wand. Attention to detail, knowledge of the equipment, and devoting sufficient time to the job are necessary to accomplish results.

Modern commercial engines must be considered in the light of proper fuel requirements. Carburetors demand attention if best mileage is desired, and this attention requires proper test equipment. Ignition systems should be checked at periodic intervals, and more attention should be paid to correct spark timing.